dec. 27

JOURNAL of FARM ECONOMICS

UNIVERSITY OF MICHIGAN
OCT 30 1956
BUSINESS ADMINISTRATION LIBRARY

AFEA Winter Meeting in Cleveland
December, 27-29, 1956

•

Economic Aspects of the Farm Woodland Enterprise ..... *John C. Redman* 901

The Consolidation of Farming Lands in France ..... *Ronald Gatty* 911

Estimating Enterprise Production Functions from Input-Output Data on Multiple Enterprise Farms ..... *Christoph Beringer* 923

Predicting Hog Prices ..... *Clifton B. Cox and Patrick J. Luby* 931

A Modified Simplex Solution for Linear Programming with Variable Capital Restrictions ..... *Wilfred Candler* 940

Classification of Values that Serve as Motivators to Consumer Purchases ..... *M. E. John* 956

Research on Advertising Effectiveness ..... *Charles F. Sarle* 964

Questions for Designers of Future Water Policy ..... *Edward A. Ackerman* 971

Short Cuts in Programming Computations ... *James N. Boles* 981

Teaching Economics in Colleges and Universities ..... *George K. Brinegar* 991

An Analysis of the First Interim Report of the New House Subcommittee on Family-Size Farms .... *Norman F. Keiser* 998

•

THE AMERICAN FARM ECONOMIC ASSOCIATION
Volume XXXVIII NOVEMBER, 1956 Number 4

CONTENTS *(Continued)*

Outcome of Land Reform in the Republic of Korea ..... *Ki Hyuk Pak* 1015

Migration and Factor Adjustment in Lower Mississippi Valley Agriculture: 1940-50 ..... *Frank T. Bachmura* 1024

NOTES

Note on Farm Tenancy and Urbanization ..... *Otis Dudley Duncan* 1043

The Income Position of West German Agriculture: A Review Note ..... *Philip M. Raup* 1048

Galbraith's Stinger ..... *Bushrod W. Allin* 1054

A Note on Demand Elasticity, Prices, and the Business Cycle ..... *Lawrence E. Fouraker* 1056

Computation of the R Column of the Simplex Linear Programming Worksheet ..... *Horace L. Puterbaugh* 1058

PUBLICATIONS RECEIVED 1059

REVIEWS:

William H. Nicholls (Technical Director), *United States Agriculture: Perspectives and Prospects* ..... *Ronald L. Mighell* 1062

Walter W. Wilcox, *Social Responsibility in Farm Leadership* ..... *Lauren K. Soth* 1064

Gunnar Myrdal, *An International Economy* ..... *Robert B. Schwenger* 1066

Earl O. Heady, Glenn L. Johnson, and Lowell S. Hardin (editors), *Resource Productivity, Returns to Scale, and Farm Size* ..... *B. F. Stanton* 1068

Charles P. Kindleberger, *The Terms of Trade: A European Case Study* ..... *Bernard Goodman* 1071

Roemer-Scheibe-Schmidt-Woermann Paul Parey (editors), *Wirtschaftslehre des Landbaus, Handbuch der Landwirtschaft* ..... *Günther Weinschenck* 1073

Samuel T. Dana, *Forest and Range Policy: Its Development in the United States* ..... *M. B. Dickerman* 1075

Policies to Combat Depression (review of papers by Karl A. Fox and D. Gale Johnson) ..... *George S. Tolley* 1077

Heinz Gollnick, *Die Nachfrage nach Nahrungsmitteln und ihre Abhaengigkeit von Preisund Einkommensaenderungen* ..... *Werner Z. Hirsch* 1079

NEWS NOTES 1082

AFEA Winter Meeting, Cleveland, December 27-29, 1956 1090

Price: $7 per year, this issue $1.75

Entered as second class matter at the post office at Menasha, Wis. Acceptance for mailing at a special rate of postage provided for in the Act of February 28, 1925, paragraph 4, section 412, P.L.&R., authorized November 27, 1931. Printed in U.S.A.

THE JOURNAL OF FARM ECONOMICS is published five times a year during February, May, August, November and December by The American Farm Economic Association. Yearly subscriptions $7. Published at Menasha, Wisconsin.

JOURNAL
OF
FARM ECONOMICS

Volume XXXVIII NOVEMBER, 1956 Number 4

ECONOMIC ASPECTS OF THE FARM WOODLAND ENTERPRISE*

JOHN C. REDMAN[1]
University of Kentucky

ON FARMS in many regions acreage in timber has steadily decreased and the acreage of cropland has increased to meet the needs of a growing population. In many of these regions, timber clearing may have been excessive yet some of the land left in trees is potentially excellent cropland. The history of the Eastern Pennyroyal Area of Kentucky upon which this study is based indicates that most farmers cut over their woodland rather indiscriminately, particularly when prices were high, and cleared the better land for crop production. The productivity of the farm resources devoted to timber is often very low as compared with other alternatives, and consequently only a few farmers consider woodland as a significant farm enterprise.

Objectives of Study

Because of the encouragement farmers receive to "tree farm," there is a need (1) to provide estimates of the physical productivity of farm woodland on different sites and (2) to appraise the possibilities of woodland as a farm investment. In this connection, attention will be directed also to the role of technical and price uncertainties that may affect a farmer's plan of resource use in fitting a woodland enterprise into his farm production plan. Considerable risk is involved in making long-run growth estimates for a tract of timber and perhaps still greater risk is involved in making price estimates of timber products relative to other

* The investigation reported in this paper is, in part, in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the director.

[1] The author is indebted greatly to W. B. Back and P. S. McComas, formerly at the Kentucky Agricultural Experiment Station, and to Benn Hornbeck, Forester, Kentucky Agricultural Experiment Station, for their work in initiating and conducting the larger part of the research project that provided the basic data upon which this paper is based.

farm products. Fortunately, an appropriate tool in economic analysis is available to determine the optimum age to harvest and to provide a basis to evaluate the expected future returns at the present time. Such problems can be handled advantageously with the concepts employed in discounting and compounding problems.

Site Quality and Tree Growth

Appraisal of land for any use whether for timber or for crop production depends not only upon price relationships but upon the quality or productivity and organization of individual farm resources for each use. The qualities of a site classed as good, medium, and poor for tree growth were determined (1) by average growth in cubic feet for an average tree in the main stand[2] and (2) by characteristics of the soil and the physical environment. The average tree in the main stand of each plot selected and studied was determined by finding the average diameter and the

TABLE 1. AVERAGE DIAMETER, HEIGHT, AND CUBIC-FOOT VOLUME OF TREES IN THE MAIN STAND, BY AGE AND SITE QUALITY, EASTERN PENNYROYL AREA

Age	Good site			Medium Site			Poor Site		
	Av. diam.	Av. ht.	Av. vol.	Av. dia.	Av. ht.	Av. vol.	Av. dia.	Av. ht.	Av. vol.
yrs.	in.	ft.	cu. ft.	in.	ft.	cu. ft.	in.	ft.	cu. ft.
30	9.3	51	9.1	6.4	41	3.5	4.2	32	1.3
40	12.2	63	19.1	9.4	52	9.4	6.7	42	4.0
50	14.6	73	31.6	11.8	61	17.3	9.0	50	8.5
60	16.5	84	45.2	13.8	70	26.6	10.9	56	14.3
70	17.8	90	56.9	15.2	77	35.6	12.4	64	20.0
80	18.6	94	65.0	16.2	82	43.0	13.5	69	26.3
90	18.9	96	67.9	16.2	84	48.0	14.3	73	31.1
100	19.1	97	69.4	16.8	85	50.9	14.7	75	34.3

average height for different age intervals. The diameter, height, and growth in cubic feet according to site quality were expressed in terms of this average tree (Table 1).

Differences in quality of site caused considerable differences in the range of cubic-foot volume for a given age (Table 2). Characteristics of the soil provide a basis for determining site quality for timber use as compared with other uses. Slope of land, texture and depth of soil, drainage of subsoil and location of site with respect to surface drainage affect the amount, distribution, and availability of soil moisture which is a major determining factor in site quality. The most serious limitations

[2] Main stand refers to the principal developing body of timber whose ages form a more or less compact distribution, set apart often by considerable gaps from ages of the "older stand" and "younger stand."

TABLE 2. RANGE OF AVERAGE CUBIC-FOOT VOLUME OF TREES FOR GOOD, MEDIUM, AND POOR SITES, BY AVERAGE AGE OF MAIN STAND

Average age yrs.	Average cubic-foot volume of trees					
	Good Site		Medium Site		Poor Site	
	Lower Limit	Average	Range	Average	Upper limit	Average
30	6.3	9.1	2.4– 6.3	3.5	2.4	1.3
40	14.3	19.1	6.7–14.3	9.4	6.7	4.0
50	24.5	31.6	12.9–24.5	17.3	12.9	8.5
60	45.2	45.2	20.4–35.9	26.6	20.4	14.3
70	46.3	56.9	27.8–46.3	35.6	27.8	20.0
80	54.0	65.0	34.6–54.0	43.0	34.6	26.3
90	57.9	67.9	39.6–57.9	48.0	39.6	31.1
100	60.2	69.4	42.6–60.2	50.9	42.6	34.3

upon tree growth are excessive drainage and the associated factors of shallow topsoil, displacement of organic matter, and low moisture-holding capacity. The growth patterns with respect to stream terrain, in general, are (1) good growth adjacent to the streams, (2) medium growth adjacent to coves or on the partially sheltered slopes, and (3) poor growth on steep slopes of thin shaly soils beyond the moisture influence of the stream.

Yields of Merchantable Products of Farm Woodlots

Yields of timber can be measured by cubic-foot volume, board-foot volume, cords of wood, or in terms of any of the merchantable products. In many areas, lumber is the most valuable product and data expressed in board-foot volume will be used in this report but cubic-foot volume is a useful measure of woodland yield when more than lumber is involved, and is presented for those who have need for such data.

Yield in cubic feet. The increase in cubic-foot volume per acre by 10-year periods (decadal increment) was highest in the 30- to 40-year period for good and medium quality sites and 30- to 50-year period for the poor site. It is at these age intervals for various site qualities that a large increase resulted in the number of trees per acre of merchantable size (trees 5 inches or more diameter breast high, d.b.h.). Also, these are perhaps the ages at which individual trees make the fastest growth on these site qualities. The average decadal growth in cubic feet entered the decreasing stage after this period of rapid growth, but the rate of decrease was not great for any site (Table 3). Because of the high rate of growth when stands were 50-70 years of age on good sites, 50-80 years on medium sites, and 60-90 years on poor sites, there appears to be, from a physical standpoint alone, a considerable tolerance in age for harvest to maintain a high rate of growth of the stand. However, growth

TABLE 3. AVERAGE GROSS AND DECADAL INCREMENT IN CUBIC-FOOT PER ACRE BY AGE OF MAIN STAND AND SITE QUALITY

Age	Decadal Interval[a]	Good Site		Medium Site		Poor site	
		Gross vol.[b]	Decadal incre.[c]	Gross vol.[b]	Decadal incre.[d]	Gross vol.[b]	Decadal incre.[c]
Yrs.	Yrs.	Cu. ft.	Cu. ft.	Cu. ft.	Cu. ft.	Cu. ft.	Cu. ft.
30	0– 30	1300	430	1000	330	650	220
40	30– 40	2200	900	1600	600	1150	400
50	40– 50	2850	650	2100	500	1450	400
60	50– 60	3450	600	2600	500	1800	350
70	60– 70	4000	550	3100	500	2150	350
80	70– 80	4550	550	3600	500	2500	350
90	80– 90	5050	500	4050	450	2850	350
100	90–100	5450	400	4400	350	3150	300

[a] The interval in years applies to the decadal increment in cubic feet.
[b] Rounded to nearest 50 cubic feet.
[c] A rough approximation of the annual growth can be determined by dividing the decadal increments by 10.

in cubic-foot volume is not comparable to net annual yields in board feet.[3]

Yield in board feet. The gross and net board-foot volumes were computed by the international ¼ inch rule (Table 4 and Fig. 1). Gross yield is the lumber content of all trees 9.0 inches (d.b.h.) and larger while net yield is the volume that remains after making deductions for cull. For unmanaged timber, the percentage of cull increases with age of stand because of damage due to storms, insects and decay.

Growth in board-foot volume is affected by the number and the rate of growth of trees per acre with merchantable board-foot volume. When disregarding the increase in number of merchantable trees, the most rapid decadal growth in board-foot volume occurred at 50-60 years for good sites, 60-70 years for medium sites and 70-80 years for poor sites (Table 5). At these age intervals, the maximum number of trees yielding board-foot volume had not been attained. The maximum number of sawlog trees in the stands occurred, on the average, at about 80 years for good sites, 90 years for medium sites, and 100 years for poor sites. However, when the maximum number of merchantable trees was attained, the growth in board feet for stands was in the declining stage.

Quality, an important factor in growing timber, lags behind the annual increases in physical volume. Therefore, both volume and quality must

[3] Trees 5.0 inches and above d.b.h. were measured in cubic-foot volume. Trees 9.0 inches and above d.b.h. with at least 8 feet to an 8-inch top inside bark were measured in board-foot volume. Also, the number of trees yielding cubic feet were not comparable to the number yielding board feet, and neither will remain constant for a very long period of time.

TABLE 4. AVERAGE GROSS AND NET BOARD-FOOT YIELDS AND AVERAGE NUMBER OF SAWLOG TREES PER ACRE, BY SITES AND AGES

Age main stand Yrs.	Good site			Medium site			Poor site		
	Gross[a] BFV	Net[a] BFV	No. III saw-log trees	Gross[a] BFV	Net[a] BFV	No. III saw-log trees	Gross[a] BFV	Net[a] BFV	No. III saw-log trees
30	800	700	37	250	200	21	—	—	—
40	2300	2000	52	650	550	33	250	200	21
50	5500	4900	59	2000	1800	50	800	700	50
60	10100	8850	64	4900	4300	60	1950	1650	61
70	13600	12100	68	8400	7300	67	3950	3150	66
80	16600	14400	70	11400	9800	69	6650	5400	69
90	18700	15900	70	13700	11500	71	9050	7450	71
100	20500	16800	70	15300	12600	71	11350	9000	72

[a] Yields-rounded to nearest 50 board feet.

be considered simultaneously and for this reason age intervals to harvest are extended perhaps to 50-80 years for good sites, 60-90 years for medium sites, and 70-100 years for poor sites. The annual net growth during a decade within these intervals varied between 395 and 230 board feet, 300 and 170 board feet, and 255 to 155 board feet respectively for these sites (Table 5).

Equilibrium in Time

The principal problem is to determine the optimum age and rate of harvesting. The solution lies in the relationship of the rate of annual increase in volume and quality expressed in value of timber products and the annual cost of growing the timber. The maximum net revenue will result when the marginal value product of a unit of time (increase in the total revenue which results from a unit increase in time) is equal to the marginal factor cost of time (the increase in the total cost which

TABLE 5. ESTIMATED DECADAL GROWTH IN BOARD-FOOT VOLUME PER ACRE, BY SITE QUALITY AND AGE INTERVAL FOR MAIN STAND

Age interval, years	Good site		Medium site		Poor site	
	Gross BFV	Net BFV	Gross BFV	Net BFV	Gross BFV	Net BFV
0- 30	250	200	100	70	—	—
30- 40	1500	1300	400	350	250	200
40- 50	3200	2900	1350	1250	550	500
50- 60	4600	3950	2950	2500	1150	950
60- 70	3500	3250	3500	3000	2000	1500
70- 80	3000	2350	3000	2500	2700	2250
80- 90	2100	1500	2300	1700	2400	2050
90-100	1800	900	1600	1100	2300	1550

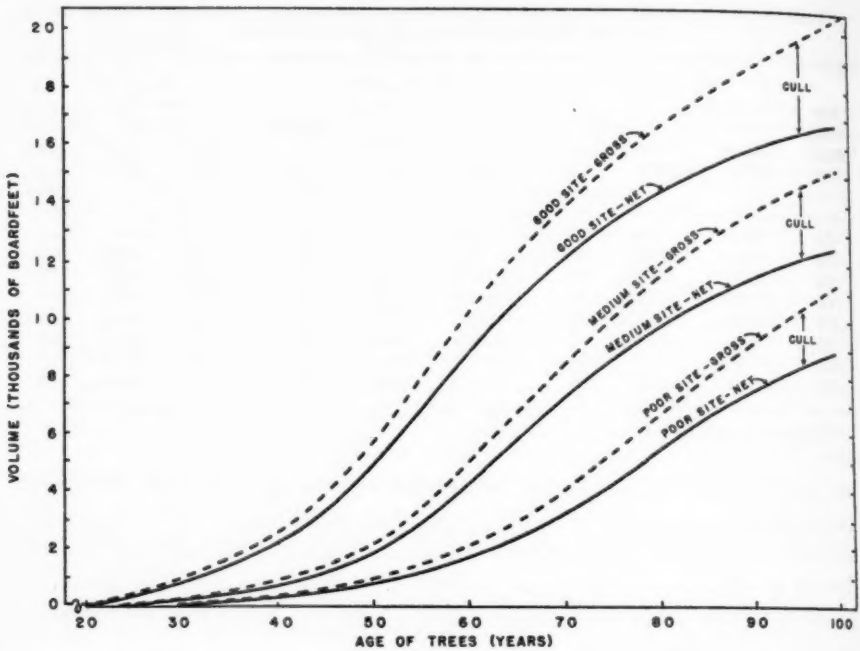


FIG. 1. THE GROSS AND NET GROWTH CURVES OF HARDWOOD TIMBER ON DIFFERENT SITE QUALITIES

results from a unit increase in time). However, owing to the time factor, the farmers do not desire to maximize the net revenue. Instead, maximum discounted net revenue is desired, which occurs when the rate of increase in revenue is equal to the rate of cost increase and occurs at an earlier date than the maximum net revenue itself.[4] It is still, however, a problem of marginality since net discounted revenue continues to increase as long as the percent added to the total revenue in each year is greater than the percent added to the costs.[5]

The rate of revenue increase is found by dividing the absolute increase in total revenue between two dates by the total revenue at the earlier date. The curves representing the total physical product in board feet of lumber from the 3 different site qualities (Fig. 1) will have the same rate of increase as the respective total revenue curves (Fig. 2) if the price of lumber, say per 1,000 board feet, remains constant for any

[4] For a discussion of the model used here, see Kenneth E. Boulding, *Economic Analysis* (3rd ed.) New York: Harper Bros., 1955, Chapter 39.

[5] Procedures stemming from pure discounting problems generally assume that knowledge of the future approaches perfection, unlimited capital, and profit maximization.

unit or units of time under consideration by the farmer.[6] Thus, the productivity and revenue curves can show identical relationships, i.e., total physical product multiplied by its price will give total revenue over time.

The rate of cost increase is the rate at which the total cost increases from year to year and is found by dividing the absolute increase in cost between two units of time by the total cost at an earlier date. The annual cash outlay for maintenance of forest does not appear to vary much over time.[7] Thus, the size of the rate of cost increase in lumber production can be considered as equivalent to the rate earned if the invested capital had been allocated to other uses.[8] The range can be all the way from the low of 3 percent if invested in insured savings issues to whatever the farmer thinks he can safely earn if allocated to farm or other investments.[9] The rate that can be earned from such investments is more appropriate than the market rate of interest as a basis in compounding or discounting problems.

The investment, when compounded annually at the rate of earning obtained if invested in other uses, will provide the total cost curve (Fig. 2), which can be regarded as revenue foregone from other sources to produce trees. Cost rates of 2¼, 3 and 4 percent have been considered. According to the data presented in this study, any earning power of an investment compounded annually above 4 percent cannot be expected from lumber production from hardwoods.

The optimum point in time to harvest trees will be when the rate of revenue increase and the rate of cost increase are equal. This will occur when some one of the cost curves representing the rate of cost increase under consideration is tangent to the total revenue curve. In hardwood lumber production on good sites (Fig. 2) this equilibrium occurs at the age of approximately 60 years when rate of cost increase is 4 percent.[10] This means that, for example, $10 invested per acre today

[6] The lag in quality if reflected in revenue is a factor causing the rate of increase of total revenue to be different than that of physical volume. This will not be considered here.

[7] It is not essential to assume a constant rate of cost increase.

[8] Most of the cash outlay involved in producing lumber occurs at the start of the enterprise, and the annual cash outlays for this example are assumed to have insignificant effect on the rate of cost increase.

[9] This does not include the alternative earning power of the dollar value of lumber. A part of the cost of continuing in lumber production from 50 to 60 years, for example, is the earnings forgone by not harvesting at 50 years and investing the money in other alternatives.

[10] Actually there is no point of tangency with 4 percent and hence no equilibrium. However, due to possible deviation of the productivity curve on good sites, it can be assumed to be close enough for practical purposes. Perhaps 3¾ percent would be a more appropriate rate to use but 4 percent is about the maximum to be expected from hardwood lumber production.

in establishing a hardwood forest on good sites will yield not more than 4 percent at harvest time, 60 years hence with stumpage value of lumber at $10 per 1,000 board feet. During the 20- to 60-year interval, the rate of increase in total revenue is greater than the rate of increase in cost, but during the 0-20 year interval there is no revenue from lumber. Medium and poor quality sites will not yield 4 percent compounded annually in value of board feet of lumber but will return approximately 3 and 2¼ percent on investment at 75 and 90 years respectively (Fig. 2). If the rates of cost increase can be kept below these levels, then a dis-

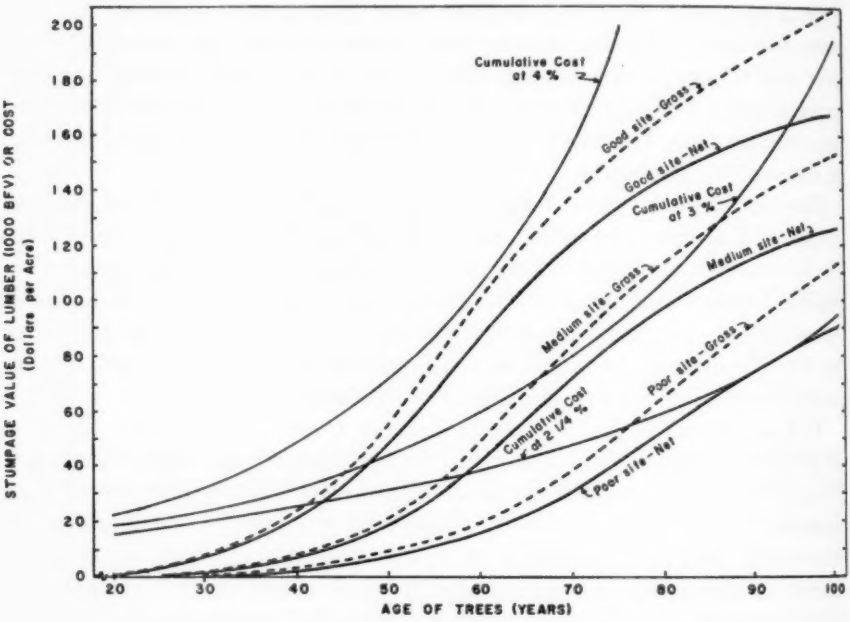


FIG. 2. RELATIONSHIP OF TOTAL REVENUE AND COST OVER TIME

counted net revenue can be realized. For example, if the investment in the good site has no alternative use yielding above 2¼ percent, then a discounted net income can be obtained but if used on poor site the discounted net income would be zero. Stated another way, if the value of lumber produced at 60 years is discounted at the rate of 4 percent, there would be no net discounted revenue and only the initial investment would remain. Likewise, if the value of lumber produced on medium and poor sites at the ages of 75 and 90 years were discounted at 3 and 2¼ percent, respectively, the present value of the lumber on both sites would equal the original investment.

Economic Implications

A majority of farmers have limited the use of capital in developing efficient farm units with crop and livestock enterprises. Additional capital would yield a high return if invested in these enterprises. Since farmers usually prefer security afforded by debt-free assets, the stock of timber has been a ready and more preferable source of funds than from the lending agencies. The low rate of return on hardwood forests also encourages liquidation of woodland assets, particularly when those resources have other uses. Not only can capital from forests be used elsewhere in the farm business but the land, particularly the sites of good quality, may provide pasture or feed for a livestock enterprise.

As shown (Table 3) the marginal decadal increments of production are somewhat constant over a period of 20 to 30 years during which the price will be the major factor in deciding when to cut. In general, lumber prices bear a close relationship to the business cycle.[11] Production fluctuates considerably as a result of mills going in to production and out of production. The forces bringing about erratic price movements are virtually impossible for a farmer to predict. Lumber prices for hardwood species vary from \$3 to \$10 per 1,000 board feet from one year to another. This encourages light and heavy cuttings to maximize income.

Uncertainties of yield and price predictions encourage practices that result in preferences for a more certain present income although long-run income may be larger. This rate of discount is the farmer's own estimate of what constitutes a reasonable return on woodland investment. His idea of reasonable return is affected by nonmonetary values, relative capital position and needs for capital, or additional cropland and degree of uncertainty envisioned. The need for capital or awareness of a high rate of return from alternative uses tends to increase the farmer's discount rate. The degree of uncertainty is enhanced because of the difficulty of using the concept of flexibility to adjust resources to keep the proper relationship with other farm enterprises.[12] When the farmer's discount rate is higher than the market rate of interest, clear-cutting and selling timber is encouraged, and conversely, if his discount rate is lower than the market rate, he is encouraged to invest in woodland. In the area under study, the past cutting practices indicate that the prevalent discount rates have been higher than the market interest rates. This means that when uncertainty is present the internal rate, which is affected

[11] Lumber prices depend on building investments which in turn are affected by the level of national employment and income and government policy.

[12] Adjustments to conditions favorable for clear cutting can be made rather quickly, but little can be done to increase the woodland enterprise in the short run.

by subjective considerations, is used by farmers rather than the market interest rate. Under imperfect knowledge, which obviously exists in the forest enterprise, farmers are likely to discount the income at increasingly subjective rates as estimates of the future income become less accurate.

Summary and Conclusions

Tree growth data from adequately stocked stands indicate that the equilibrium of not more than a 4 percent rate of return on investment and the rate increase in value of lumber will occur at 60 years on sites of good quality. For sites of medium quality and poor quality the maximum of 3 percent and 2¼ percent can be earned at 75 years and 90 years respectively. When the total amount earned at each of these respective ages and site qualities under the assumed price relationships is discounted back to the present at their respective rates of earning, the farmer would have his investment value with no net discounted revenue from the forest enterprise.

These productivity estimates, coupled with fluctuations in lumber prices and the need for capital in other farm uses, explain the economic basis for disinvestment in the forest enterprise. Clear cutting of woodland has been an important source of capital for more certain production and family living and permits the release of land for other enterprises. However, the rate of disinvestment in farm woodland has been lower in recent years due to the limited amount of timber occupying potentially good cultivatable land and to the increased opportunities for increasing farm income without disinvesting in timber. For most farmers, there appears to be no economic incentive to invest in production of hardwood lumber. Therefore, such investments, if made, must be from the social and national standpoint.

THE CONSOLIDATION OF FARMING LANDS IN FRANCE

RONALD GATTY*
Cornell University

The Problem of Land Fragmentation

FRAGMENTATION of farming lands is widely recognized as a deterrent to any greatly increased agricultural production in France. The problem is often expressed and perhaps even exaggerated in strongly worded statements, for one finds an author such as Schmerber writing that tremendous land consolidations are imperative and that without them we shall witness the paralysis of French agriculture and perhaps the paralysis of the whole French economy.[1] In broad perspective there are about 10 million ha. of fragmented land, roughly half the arable land of France. Fragmentation is most serious in areas of open field cultivation where houses are grouped into compact villages and where the fields are long and narrow (the Paris Basin, the North and the East). In areas where residences are dispersed on the individual farms (the West) there is little problem and there is no problem at all on the approximately 10 million ha. of grazing lands.

Farm census statistics are sadly wanting but various estimates,[2] partly based on the 1946 census, do show considerable cause for concern. They show average farm area to be about 14½ ha. (one ha. equals approximately 2.4 acres) with an average of 42 fields for each farmer, these fields being called *parcelles*. Actually these figures have limited significance. The census is most inclusive in defining a farm and *parcelles* are only fields separately registered on official landownership maps (*le cadastre*). Two adjacent *parcelles* may belong to the same owner or may be rented by the same farmer, so much more important are contiguous fields under single ownership (*ilôts de propriété*) or under one farm operator (*ilôts de culture*). With a system of predominant owner operation one finds the average *ilôt de propriété* to be .85 ha. and each owner holding on the average 18 of them.

In citing a few examples of fragmented areas one might mention a

* The author is deeply grateful to Henri Corbet of Puellemontier (Haute-Marne) for advice and cooperation in field study, and to Père Henri de Farcy, S.J., Professor at the Catholic University in Paris, for thorough criticism of the manuscript. Unfortunately, at the time of writing this article one of the better sources and commentaries was not available: P. Froment, Cours miméographié professé à la Faculté de Droit de Paris 1948-49. Editions: Les cours de Droit: 158 rue St Jacques, Paris 5 éme.

[1] Jean-Marie Schmerber, *Le Réorganisation foncière en France: le Remembrement rural*, Cahors: Imprimerie A. Couselant, 1949, p. 90.

[2] See Jean Fauchon, *Economie de l'agriculture française*, Paris: Editions M.-Th. Genin, 1954, p. 24-33, 141-142, and also *Le Remembrement rural*, Paris: La Documentation Française, août 1952, p. 6-7.

commune[3] in Loiret with as many as 48,000 *parcelles* in just 2,179 ha. But much of the Loire Valley, the Northeast, Burgundy, le Béarn, the Rhône Valley and Limagne suffer extreme fragmentation. Limagne alone has only .08 ha. as the average size of *parcelles*. Over many thousands of hectares there are fields of a few square meters drastically limited in their agricultural use.[4]

Such uneconomic farms have encouraged the rural exodus to urban areas, aggravating the shortage of farm labor in France. And it is largely the lack of labor that causes the fragmented farms to be uneconomic, for consolidating the fields would allow them to be worked with less labor. It might be thought that the rural emigration would permit consolidation of farms with the good abandoned land, giving an increase in the size of farms and more rational field boundaries. In fact, except near Paris, this does not occur so often. Frequently the younger people, and perhaps the more enterprising, leave the fragmented farm behind. One hundred years ago there were 150 inhabitants in one *commune* of the Côte-d'Or. Today there are roughly 40 and the youngest is 54 years of age![5]

Looking into the origins of farmland fragmentation, one often finds that present day size of fields has not changed greatly over long decades and corresponds to the area a man could till in half a day or harvest by hand in one day. The problem has long been a dual one. First, the land is owned by too many people (there is excessive *morcellement*) and second, farms are each divided into too many fields (excessive *parcellement*). The difficulties are attributed to many historical causes. Although farms of this size were more rational economic units in the Middle Ages, such sized farms are only a fraction of the area that a farm family might work today, taking advantage of technological improvements. And such farms, under little disadvantage in having discrete fields to be worked by simple implements, find themselves now quite unsuited for mechanized operations. Even after the Middle Ages farms and fields had not become very much larger due, among other things, to equal land inheritance, formalized under Revolutionary law. Tradition was not only for each owner to operate his own land but

---

[3] After the Revolution the ancient provinces of France were divided into smaller units without respect to provincial borders. These units, called *départements*, number about 85 today and are each governed by a prefect appointed from Paris. Within *départements* land is divided into *communes*, village or township areas or sometimes, sections of a city.

[4] See Henri Brousse, *Le niveau de vie en France*, Paris: Presses universitaires de France, 1949, p. 84.

[5] Lucien Brasse-Brossard, *Le destin de l'agriculture française*, Paris: Presses universitaires de France, 1949, p. 97.

also to divide each field of his property among his children. In addition, the increase in rural population provided a pressure on the sale of small fields, which were all the country folk could afford.

The sale of confiscated land in Revolutionary times did not solve the problem. Although Church lands were confiscated, nobles' estates were for the most part not affected unless it could be proved that the noble resided outside France. What is sometimes not realized is that much of the farming land was not in the hands of the nobles at the time of the Revolution. Since the time of Francis I in the 16th century many peasants had been released by the king from paying rent for farming seigneurial lands, the nobles being reimbursed by courtly honors. By any standards the French Revolution was certainly not an agrarian revolution and the confiscated land was sold in tracts of too great an area for individual peasant purchase. Even well into the 19th century, peasant purchases of land were limited to small plots distant from the villages. Needless to say, credit facilities were not available to ease larger land investments.

More recently, in our own century, small land acquisition has taken on a new significance as an investment. The frightening inflation of the franc has led many people, some even apart from the farming population, to buy land because it is more stable in value than the currency. As might be expected, this has caused land prices to increase in some areas. It is most unfortunate when the plots of land are enclaves within a larger field and lend themselves to speculation and "hold-out" prices.

The disadvantages of fragmentation concern mainly the loss of time for labor through the dispersion of the fields and through the awkward shape and size of the fields. Dispersion of fields entails loss of time in traveling to and from the fields and loss of land to production because the land is too far away to warrant visits frequent enough to maintain land under well fertilized and rotated crops. Close surveillance of crops, of grazing animals, and of farm labor is hardly possible. The irregular shape and small size of fields not only means loss of land through more borders. The area may not even justify the farmer's labor and travel time. It may be too small to be fenced for pasturing of animals as a phase of rotation and may render any use of farm machinery uneconomic if not impossible. Along with farm machinery, roads and land improvements are rarely worthwhile investments.

To balance the picture it is well to look at some of the arguments advanced in questioning the disadvantages of fragmentation. There is among rural French people, if not among rural people over the world, a strong attachment for lands traditionally in the family. After talking of this psychological and cultural aspect, a French agriculturalist wrote

the author in personal communication that "Seuls peuvent le comprendre ceux qui ont travaillé la terre et vécu la vie des paysans. La terre est bien autre chose qu'un instrument de production. C'est une femme, ou mieux encore, une maîtresse, pour qui on sacrifie tout. Cela coûte de se détacher d'une chose à laquelle on est habitué."[6] Such sentiment might sound maudlin to American ears but nevertheless it represents a widely held attitude in France. The right to property is for the French almost sacred and any democratic legislation aimed at radically changing this right must be complex and compromised by considerable opposition. There is, moreover, the fact that farms are small and no plan has been seriously advanced that would cure this economic ill (*morcellement*). Legislation may prevent a decrease in size of farms or regroup the individual farms into more consolidated units (reducing *parcellement*). But does this actually increase production on the average farm? Perhaps the main result is to allow the farm family more leisure.

Another argument not favoring land consolidation stresses the advantages of small fields for adapting farm size to the needs of the farm family. With limited capital, peasants can enlarge their holdings only by renting or purchasing small fields; and it is through these small exchanges that flexibility is maintained, increasing or decreasing the size of farm as the family grows or becomes reduced in numbers. However convincing or unconvincing these arguments appear in cold economic light, it must be realized that they represent the feelings of many peasants and these feelings, in any democratic nation, may overrule what economists think is in the long-run interest of the people as a whole.

Early Attempts of Land Consolidation

In the face of widespread land fragmentation, French farmers may be encouraged by the possibility of consolidating their lands into more economic units with the aid of the government. On a broad scale it has been found impossible to increase the size of farms through national legislation. In this direction, the best that has been done has been since 1909 is to prevent a decrease in farm size through control of inheritance so that the smaller farms must be passed on without being broken up. Further legal clauses require that in some cases inherited land must be cultivated. Efforts in this century have been aimed rather to piecing each farm into a more contiguous area by means of a program called *remembrement*. Although this consolidation is often a monumental task, the cost is very small relative to the return. With the government now subsidizing about 80 percent of each *remembrement* operation, the

[6] Only they can understand it who have worked the land and lived the life of a farmer. Land is much more than just a factor of production. It is like a woman for whom one sacrifices all. It costs dearly to break away from something to which one is accustomed.

landowners usually pay 1,000 francs for each hectare of their land consolidated. The total outlay is normally covered in one year by 150 to 200 percent, and M. Blanc, as head of a governmental bureau (*Génie rural*) concerned with consolidation, is quoted estimating that production increases can reach as high as 15 per cent and that decreases in cost of cultivation can be as great as 30 per cent.[7] In addition, it is common that land values are raised with their increased potential productivity.[8]

Behind the present *remembrement* there is a long history of trial and error. As early as 1705 a Burgundian township set up boundary revisions but the case is an isolated one. Through the 19th century in the province of Lorraine, there was some straightening up of field borders and a reduction in the number of enclaves within larger fields. And in the *département* of Aisne as well as in Lorraine, friendly exchanges of land, without being authorized by law, have at least alleviated the problem. Friendly exchanges of this nature (called *regroupement cultural*) in Barcy, Seine-et-Marne Department, involved 750 ha. which were worked by 158 different people. One farmer-landowner managed to make private agreements with the other farmers, concentrating his former 79 *parcelles* into two fields. However, before the law of 3 August 1884, personal arrangements of this sort could not be sanctioned by government and were subject to the whims of people who might change their minds and claim back the land that was their legal right.[9]

On a national scale, the judicial basis for land consolidation dates from the law of 21 June 1865, while the laws of 27 July 1870, 21 June 1875 and 3 November 1884 gave financial easing to the heavy tax impositions on legal exchange of rural real estate. Although no statistics measure the efficacy of these laws, certainly individual exchanges were very slow. One example may suffice to illustrate this. In 1900 an estate in southern Champagne had 250 pieces of land totalling 50 ha. To transform the estate into 70 pieces of land totalling 61 ha. took 21 years of arranging 23 land purchases, 27 sales and 91 exchanges.[10]

The law of 22 December 1888 marked a new development by permitting community real estate improvements (*travaux d'améliorations foncières*) upon agreement of three fourths of the people representing two thirds of the area involved. Final approval for each operation had to come from the Cabinet (*Conseil d'Etat*) and opposition appeals were only possible through the same channels, a cumbersome process indeed, but for any advantages the law may have had, the results were again quite meager. Within ten years another law called for unanimous back-

[7] Schmerber, *op. cit.*, p. 73 and Fauchon, *op. cit.*, p. 142.
[8] *Enquête sur le remembrement*, Chambre d'agriculture de Meurthe-et-Moselle, Nancy: Imprimerie Lorraine, 1937, p. 14 and 16.
[9] *Le remembrement rural, op. cit.*, p. 14, 18.
[10] Schmerber, *op. cit.*, p. 43.

ing of the projects and still the problem was by no means solved.

World War I was necessary for legislators to realize that with a reduced farm labor force, land consolidation was the only way to maintain or increase agricultural production. Here, for the first time, fragmentation came to be considered a public problem and a public responsibility. The law of 27 November 1918 called for local land consolidation upon the favorable vote, or upon the failure to vote, of one-half the people representing two-thirds of the land or two-thirds of the people representing one-half of the land. All landowners affected were required to pay one-third of the cost, the rest being provided through government subsidy. The projects were managed by syndical farm groups (*Associations syndicales*) with an arbitration commission (*Commission arbitrale*) at the seat of each district (*canton*). The major defects of this legislation were that: 1. There was insufficient propaganda to sell the program to landowners, 2. Government officials were to participate in the projects only in an advisory capacity, 3. Arbitration commissions were set up only for specific cases, so that without continuity of membership there was lack of experience in settling disputes, 4. Land could be pooled for redistribution on the basis of area without consideration of the productive value of the soil, 5. Important landowners opposing *remembrement* could kill village projects by refusing to submit their lands; in such a case the *Association syndicale* was obliged to buy the land to include it in the pool, but often the *Association* did not have sufficient funds to buy much land and the whole project was dropped.

These defects greatly limited the possible achievements and it was not until after passage of the law of 4 March 1919 that any large area of land was regrouped. This law dealt only with war devastated areas where former boundaries were hard to find again and where much of the land had been in disuse during the war years. The work was to fall mainly on the shoulders of local commissions (*Commissions communales de reconstitution foncière*) with a majority of government officials and specialists and a minority of nominated landholders whose interests were involved. Appeals were made possible through regional commissions (*Commissions départementales de reconstitution foncière*), also with a minority of local landholding representation.

Outside of the war damaged territories of northeastern France, the 1918 law remained applicable until it was improved by the executive decree (*décret-loi*) of 30 October 1935. Here were introduced provisions that excluded from regrouping certain kinds of real estate that had caused much controversy in the past: building properties, orchards, gardens, quarries, ponds and mineral springs. Progress was made too in evaluating the contribution of each landholder for fair redistribution. Appraisal was to be on the basis of productive value of the land rather

than just the number of hectares. To help matters, regional commissions handled claims regularly, but still there was no great effort to publicize the advantages of *remembrement* and the achievements were modest. Because records are not centralized, estimates of the total area regrouped differ widely and will not be discussed here.

Present Legislation for Land Consolidation

By 1938 another law was in the making but with political events of world importance taking priority, passage of the law was deferred until after the fall of France. This Vichy law of 9 March 1941 was re-enacted by the DeGaulle Government after World War II as the *ordonnance* of 7 July 1945 and remains today the basis of land regrouping.

Anyone has the right to request that the prefect (*Préfet du département*) establish a village commission on land questions (*Commission communale de réorganisation foncière et de remembrement*). If local land reform is of particular interest to the national government, the initiative may come from a civil servant in services such as agriculture, rural engineering, taxation, forestry or reconstruction. Normally, however, it is a group of farmers or landowners who instigate the move. The prefect may reject the proposal, and it is considered that if he does not respond favorably within four months this is to be construed as a rejection without the reasons being stated. The actual reason for rejection is most frequently a lack of funds but in all cases the prefect acts with the advice of his chief of *Génie rural* and issues favorable decisions only by formal decree (*arrêté du Préfet*).

The commission appointed by the prefect is divided equally in voting power between government officials and landowners. For a total membership of nine to eleven men, there are roughly five to seven civil servants representing various specialized services and some of them serving only in an advisory capacity. Among the farmers and landowners, the village mayor and three owner-operators are chosen by the prefect to represent the interests involved. A justice of the peace (*juge de paix du canton*) presides. In situations where land ownership is complicated across village or even departmental borders there can be established an inter-village commission to iron out difficulties and perhaps even effect a coordinated land reformation in both areas.

Experience has also shown the need for a subcommission as a steering committee and to act when there is no quorum for the commission. In this way, the commission has only to meet occasionally to approve or disapprove the decisions of the subcommission. This subcommission has the advantage that its meetings require only one government official in addition to three nongovernment members of the commission and some four or five local farmers. The secretary of meetings and one of the key

men in the whole project is the surveyor, who is hired on contract by the commission from a list of professional men approved by the Ministry of Agriculture. With the village mayor presiding and with the close participation of the village council, this group can meet at short notice and deal with problems on more intimate terms than could the official body.

There is at the beginning an important decision to make: Is the village to commit itself to *remembrement*, or to reorganize its land on merely a minor scale (*réorganisation foncière*), or, as a third alternative, to put through a mild program of friendly exchanges (*échanges amiables*)? In any event, the decision is subject to review by a permanently constituted departmental commission which has its voting power divided equally between government specialists and landholding farmers of the department. But once approved, a legal vote in favor of *remembrement* is irrevocable. From friendly exchanges or from reorganisation, one may turn later to the more drastic *remembrement* but one of the strengths of the law is that there is no turning back after a decision for *remembrement* is officially adopted. To forestall any boycott of the commission meetings, it is also ordained that after a second summons no quorum is required. Decisions are carried by a simple majority, the president casting his vote in cases of stalemate.

Legally then, a community is well prepared to begin its formidable task. If the consolidation is to be a matter of friendly land exchanges between individual landowners, a special committee (*Comité d'échanges amiables*) is appointed by the prefect to be composed of village people exclusively, but having the advice of the *Génie rural*. For at least a couple of years more, certain incentives are provided by the government through the decree of 20 December 1954, an amendment and extension of the law of 9 March 1941. The state will now pay some of costs involved and will provide financial assistance amounting to five times the value of taxes on the land exchanges, as well as modifying the tax rate on exchange sales. These provisions mark a clear advance over the law of 3 August 1884 and decree of 6 April 1950, which permitted–rather than encouraged–individual land exchanges.

If the village commission chooses *réorganisation foncière*, the questions are primarily those of putting into use uncultivated land, improving rural roads and enforcing some exchanges of land where the mutual advantages are obvious. This alternative is not often elected, partly because it entails red tape comparable to that of *remembrement*, without enjoying such striking results.

Remembrement calls for much more drastic changes. The area concerned is defined–again irrevocably–and excludes only nonagricultural land such as residences, quarries, public roads and railways, and only

such farming land as is already planted to highly specialized crops that are difficult to evaluate. Although early efforts of consolidation generously excluded much land from the plans, the tendency now is towards more fundamental change with little excluded land.

With an over-all picture of the area, a study is made of the road system and of irrigation and drainage needs. Then a thorough check is carried out on present land ownership, and often enough, errors are found in the old borders. Each landowner receives a copy of the survey made on his own land and has an opportunity to protest any injustice in the mapping.

The next task is the most difficult. Each plot of land must be appraised as to its productive value and be classified accordingly. Land classes usually number about six, each assigned a nominal value and each determined on an informal basis that is almost impossible to define. It is here where judgment may be a delicate matter, meat for argument on the part of an owner who considers his land under-rated.

For each owner then, a calculation is made evaluating what he brings to the common pool, less about 2 per cent for village projects such as the road system. What he gets back from the pool is equivalent in productive value to what he contributed but his total farm area and the land classes of his fields will probably be different and only some of his former fields will be returned to him in redistribution. As far as possible, owners' preferences are respected and there is ample opportunity for complaint if the repartition is considered unfair. Recourse is even possible to the departmental commission and, in cases where the commissions are alleged to abuse the law, appeals may be registered before the administrative court (*tribunal administratif*).[11]

Once the new borders are agreed upon, dates are set for the transfer of property during a natural break in the production cycle. These new borders have the full weight of the law behind them and, in fact, enforcement is occasionally necessary since the benefits of *remembrement* are less apparent immediately than over a span of several years.

For the village commission there remains only one job. A permanent land association (*Association foncière*) must be established to undertake local projects of common interest decided upon by the village commission, projects such as the redesigning and building of a better road system and drainage ditches. While the government may aid in the heavy initial costs of community projects, the village people must bear the expenses of upkeep. For individual far improvements too, some aid may be available but in all cases the continuing costs are borne individually.

[11] Under Article 4 of the basic law this latter type of appeal could go before the Cabinet but through the decrees of 30 September and 28 November 1953 this function was taken over by the administrative court.

Individual farm improvements may include filling in old ditches, removing fences no longer needed and the ploughing of land that had been laid down to rural roads.

The over-all cost of *remembrement* to the farmers is low, since much of the paper work is done by civil servants and since the services of government specialists and commission members are without charge. All expenses are paid initially by the state and subsidized to the extent of about 80 per cent,[12] after which the state then collects the appropriate pro-rated amount from each landowner in two payments spread over a sufficient period of time. One can only conclude that the average cost to the landowner, about 1000 francs per hectare, is little enough to pay for such urgent and fundamental reform.

An Example of Remembrement

There is available a small number of case studies that give striking evidence of the value of *remembrement*. They will not be discussed here but some comments on the Puellemontier (Haute-Marne) project may help point up some of the problems encountered.

Puellemontier is a typical village of the Der region of southern Champagne, a holstein dairy area with some general farming and fruit culture. The main problem is one of poor drainage and acid soil, limiting the cultivation of crops for the barn feeding necessary during five months of the year. A common rotation would include wheat, oats, clover or a root crop. The total village area is 2,500 ha. and the number of inhabitants is 241.

Although the village is free of internal conflicts on land questions and although it is certainly a progressive community, *remembrement* was a painfully long process. The initial work was authorized in August 1949 but the plans were not completed until April 1953. To begin with, the village was committed to *remembrement* through the pressure of some of the more prosperous farmers. When the village people were called to vote on the question of land reform they were given a rosy picture of the prospects and certainly had little idea of the far-reaching implications of what they were undertaking.

Once the commission was constituted the problems came pouring in. Discussion and arguments ran far into the early hours of the morning for as long as two years. For the most part, commission and subcommission members were conscientious and sincere even though inexperienced in

[12] Rates of village contribution are established by a regulation (*arrêté d'application*) of 9 November 1942 which states 80 per cent government subsidy to be the maximum base amount, and allowing for an increase of 5 to 10 per cent if the reformed area is equal to at least 4/5 of the village lands and an increase of 10 to 15 per cent if the village has suffered severe war damage. However, in order to encourage or restrain requests for *remembrement*, the ministers of Agriculture and Finance are authorized to alter the rate of subsidy.

land reform. Only in a couple of cases was it felt that some of the members were prejudiced in ther own favor.

One of the first and perhaps most important of difficulties soon became apparent. The law had made little or no provision for tenant farmers. Let us realize that this is something of a limitation since in France 30 per cent of the cultivated area is rented and 10 per cent is under a share-cropping system. Of the total number of farms, 3.6 million, as many as 700 thousand are rented and 200 thousand share cropped.[13]

In Puellemontier, however, there are few tenants who don't own some land, so almost all the farmers are eligible to serve on the various commissions. But since land is usually rented in small strips from different landowners and pieced together to make up a farm, how should the commission redefine the borders, on a rational basis of the land as it is farmed, or as it is owned? Henri Corbet, village mayor, has a prosperous farm of 116 ha. but all except 32 ha. is rented. These 32 ha. alone were formerly divided into 43 separate lots in Puellemontier and the neighboring village of Ceffonds. Just to consolidate the 43 lots into 9 lots was a monumental task, without considering the far greater area rented. Nevertheless, the commission did what it could to redesign the farms on the basis of farming operations on both rented and owned land, for there is the saving grace that leases are of long-term duration and represent semipermanent acquisitions.[14]

Complications arose also with the nearby communities of Ceffonds and Montier-en-Der, for frequently farmers of one village owned or rented land in another one. Eventually cooperation was possible with Ceffonds, a farming village much like Puellemontier. As far as possible, farmers were distributed land closer to home for what they had held in the other village. With Montier-en-Der cooperation was not so easy, for this *commune* is more urban, being the town seat of the *canton*. Here townsmen were most reticent to give up pieces of land that represented either garden areas or specific investments. Not being farmers, they had less to gain and this reflected strongly in their attitude.

Within Puellemontier there are some impressive examples of land

[13] Léon Roche, "Le Remembrement rural," in *Nouveau Larousse agricole*, Paris: Librairie Larousse, 1952, p. 1098. See also Fauchon, *op. cit.*, p. 38, 43 where the total number of farms is given as just under 2.5 million, about 34 per cent of them rented and 11 per cent share-cropped.

[14] Under a law of 1946 (*la loi sur le statut de fermage*), all leases run at least nine years, and if the rented land exceeds 5 ha., they carry with them a tenant's option to buy if the owner decides to sell. Concelling of a lease before the expiration date, or increasing of rent, can be effected only by mutual consent of tenant and owner or by decision of a special commission of three tenants and three landowners elected by the community. Even after the nine year period a landlord may take back his land only if he is to operate it himself. At the end of three year periods the land may be freed from the lease if the landlord's son will use it.

consolidation. An area called Les Royes Tortues was reduced from about 24 *parcelles* to two fields and one small excluded area. Les Bas Parme was consolidated from eight *parcelles* to one *parcelle* and one excluded area; La Cour from 14 to four *parcelles*.

There was, of course, some ill feeling in the exchanges but it was mostly from unjustified fears. A few farmers were led to bad words and there was at least one who threatened to resort to his shotgun if anyone set foot on his land. Another man, after harvesting his wheat crop, and knowing the exchange date to be the next April, schemingly planted yet another wheat crop, violating the crop rotation system and, incidentally, the law. Legally, after April, he no longer owned the crop but the new owner let him harvest it to avoid further ill feeling.

Quite a few people felt disgruntled in the Laborde hamlet of the *commune*. Lying at the base of a long, relatively infertile slope near the *commune* borders, the hamlet was obliged to exchange its more fertile distant holdings for a larger area of the closer, infertile slope. Perhaps time will cool tempers and show that here too, *remembrement* has been advantageous.

Any calculation of increased productivity due to *remembrement* must await the final improvements of the land association, improvements estimated to be costing 200 million francs, mostly for water control and bridges. This is approximately the same cost as the land redistribution itself but in addition, there are individual farm improvements such as fencing, ditching, contouring and the cutting of trees and stumping. Trees, in fact, have been a considerable nuisance, since they were often planted on strips of fertile land too small to put under the plough. Now that the strips are consolidated, trees are obstructions and the former owner has as long as five years to remove them if he wishes.

In retrospect, commission members see some of their mistakes quite clearly. They were far too generous in excluding land from the reform. Owners sometimes vociferously claimed land as being under specialized use and not subject to *remembrement*. Then after the land was excluded, as in the case of one orchard, they never tended the crop, never harvested it or even visited it. Consequently there are still too many small plots of land in uneconomic use. The commission was far too generous also in putting aside land for village use. There is now too much road space and unused roadside area, and there are drainage ditches that take more room than is necessary.

The faults of the *remembrement* are nevertheless minor. Most of the farmers now appreciate the advantages they have gained, and among them are a few who know that *remembrement* is never really finished. With each technological advance in agriculture, the need increases for even further land consolidation to put French agriculture on a competitive basis.

ESTIMATING ENTERPRISE PRODUCTION FUNCTIONS FROM INPUT-OUTPUT DATA ON MULTIPLE ENTERPRISE FARMS[1]

CHRISTOPH BERINGER
University of Idaho

I

DURING the last two decades a number of research workers in economics and agricultual economics have attempted to obtain statistical estimates of firm or industry production functions. In this work as in other types of empirical estimation, difficulties were encountered that are attributable either to the particular type of mathematical function employed in an analysis or they are related to production function estimation in general and are not peculiar to any one mathematical function.

A difficulty of the latter type is encountered in analyzing data from farm businesses with a series of important enterprises. If these enterprises operate on different production functions, one function fitted to data from several enterprises may cut across individual enterprise production functions and may not approximate any one enterprise function correctly.[2] In the past this difficulty was implicitly recognized by those research workers who confined their analysis to farms which specialized in the production of one major product. In addition there have been two studies that recognized the difficulty existing on multiple enterprise farms and tried to estimate separate production functions for individual enterprises on the same farm unit.[3] Neither of these studies, however, dis-

[1] This article is a summary of an unpublished Ph.D. dissertation entitled, "A Method of Estimating Marginal Value Productivities of Input and Investment Categories on Multiple Enterprise Farms," Michigan State University, 1955. The author is greatly indebted to Dr. Glenn L. Johnson at Michigan State University under whose guidance the underlying research work was conducted. Dr. Roy Wilcox and the late Dr. P. E. Johnston, University of Illinois, made it possible to carry out the empirical part of the study by providing access to the Illinois detailed farm enterprise cost accounts. Their help and the assistance given by other staff members at the University of Illinois is deeply appreciated.

[2] This problem is somewhat similar to the one pointed out by Professor Bronfenbrenner who addressed himself to the problem of fitting one industry-wide production function when in fact individual firms within the industry are not homogeneous and operate on different production functions. Cf. Martin Bronnfenbrenner, "Production Functions: Cobb-Douglas, Interfirm, Intrafirm," *Econometrica*, Vol. 12, January 1944.

[3] Burton French, "Estimation by Simultaneous Equations of Resource Productivities from Time Series and Cross Sectional Farm Observations," Unpublished Ph.D. Dissertation, Iowa State College, 1952. Darell Fienup, "Resource Productivity on Montana Dry Land Crop Farms," Mimeograph Circular 66, Montana State College Agricultural Experiment Station, Bozeman, Montana, 1952.

cussed the existing relationships among enterprises. The estimation of the individual functions was not done on the basis of detailed enterprise cost accounts but rather on the basis of arbitrary allocation of the total quantity of inputs and investments used on the farm to individual enterprises.

The function most widely used for production function analysis was a power function of the type $X_1 = aX_2^{b_2} X_3^{b_3} \ldots X_n^{b_n}$. This was introduced by C. W. Cobb and P. H. Douglas in their attempt to determine the relative contribution of labor and capital to the gross national product of the United States economy.[4]

In agricultural economics the Cobb-Douglas function has found micro-economic applications that are aimed mainly at estimating production functions of individual farm firms.[5] Empirical workers preferred the Cobb-Douglas to other curvilinear functions for two principal reasons: (a) it is linear in logarithmic form and can thus be fitted easily to empirical data, and (b) the number of parameters to be estimated is small making it possible to carry out an analysis with a relatively small number of observations. Since its first application, critics have pointed out a number of serious shortcomings of the Cobb-Douglas approach. Most of these shortcomings, however, are due to the mathematical nature of the function and therefore are not the primary concern of this discussion.

II

This article reports an attempt to broaden functional analysis to make it applicable to analysis of data from farms that operate more than one major enterprise. More specifically, appropriate means for estimating enterprise production functions were investigated for the different conditions that may exist on multiple enterprise farms.

The analysis is in three parts, *one* dealing with certain alternative methodologies to be used in estimating individual enterprise production functions, *another* dealing with accounting methods, and a *third* with an application of one of the methods considered to data produced by the University of Illinois enterprise cost accounting work.

---

[4] P. H. Douglas and C. W. Cobb, "A Theory of Production," *American Economic Review*, Vol. 18, 1928 (supplement).

[5] Gerhard Tintner and O. H. Brownlee, "Production Functions Derived from Farm Records," *Journal of Farm Economics*, Vol. 26, 1944. Earl O. Heady, "Production Functions from a Random Sample of Farms," *Journal of Farm Economics*, Vol. 28, 1946. Glenn L. Johnson, "Sources of Income on Upland Marshall County Farms," Progress Report No. 1, and "Sources of Income on Upland McCracken County Farms," Progress Report No. 2, Lexington: Kentucky Agricultural Experiment Station, 1952. (Although numerous other micro-economic applications have been made, we are limiting reference to the articles cited, which can be considered pacemaking in this field.)

III

Before appropriate methods of estimating enterprise production functions can be determined, it is necessary to investigate the nature of the relationships existing among the production functions of different enterprises on any one farm or group of farms. If these production functions are mutually dependent such that each change of scale or technology in enterprise affects one production function in other enterprises, a different methodology may be applicable than in the case where the functions are independent of each other. In the first case enterprise production functions may not be isolated by fitting functions independently to enterprise input-output data. In case of such a structural dependence among individual enterprise production functions, any one enterprise cannot be looked upon in isolation except under very special circumstances. Changes occurring within any one enterprise as well as the effects of these changes upon the production function of other enterprises would have to be considered.

Three multi-equational approaches were considered as applicable under varying conditions of dependency among production functions. These three approaches consist (1) of a system of economic relationships (equations) that are mutually dependent, where the constants of the relationships are estimated simultaneously; (2) of a system of economic relationships, one for each major enterprise, where the constants are estimated for each relationship (equation) independently of other equations and from enterprise data on multiple enterprise farms, and (3) of a system of relationships, constants of each one estimated independently and from data from a specializing farm, the result of these estimates to be applied to individual enterprises on multiple enterprise farms.

Approach (1) may be applicable in those instances where the production functions of individual enterprises on a farm are structurally dependent. Each change in either the scale or the technology in one enterprise would change the production function in other enterprises. A "change in the production function" in this context occurs if either one of the following phenomena takes place: (a) production factors previously employed in the production of a product are eliminated or replaced by others; or (b) new production factors previously not used are added in the production of a particular product. Changes in the relative quantities of production factors employed are *not* structural changes since they reflect a shift of production along the production surface but not a change in the production surface as such.

Approach (2), a system of production functions each one estimated independently from enterprise input-output data from multiple enterprise farms, appears applicable in those instances where the production func-

tions of individual enterprises can be assumed to be independent of each other.

Approach (3), a series of production functions each one estimated independently from data from specializing farms, appears applicable if enterprises on multiple enterprise farms can be assumed to be independent of each other and to be operating along the same production function as the corresponding enterprises on specializing farms.

In order to investigate the dependency among production functions and thus determine which one of the three approaches outlined above applies, it was necessary to consider the various input-input and product-product complementarities, as well as internal and external economies that might exist on farms with more than one enterprise. The reasoning process followed is reported in detail elsewhere.[6] The conclusions reached were the following: (1) Various forms of complementarity that might exist within one enterprise, or among enterprises, are not likely to change the nature of the physical production functions for individual enterprises. This does not exclude the possibility that the optimum combination of production factors along the production function of individual enterprises is different from the optimum that would apply if these complementarities were nonexistent. This statement holds only as long as the inputs are not priced in terms of their on-farm opportunity costs. Otherwise the production function would change every time the relative prices of inputs change. (2) Internal economies and diseconomies that exist on farms where more than one major enterprise is present are not factors that change the physical production function even though the scale line on the production surface might differ considerably from the one applicable on specializing farms. (3) In case of byproduct complementarities, accurate accounting (crediting the input to the enterprise producing the byproduct and charging the enterprise utilizing the input with the byproduct consumed) will contribute to keep the production functions from becoming apparently dependent.

By generalizing from these arguments the conclusion was reached that enterprise production functions on multiple enterprise farms are independent of each other but are usually not the same as the corresponding functions on specializing farms. Production processes on multiple enterprise farms are likely to differ considerably from those on specializing farms due to the availability of byproducts that can be utilized and substituted for commercial inputs.

As a result, it is not considered necessary to use the simultaneous equa-

[6] A detailed description of the reasoning that was followed in this investigation may be found in Christoph Beringer, "Problems in Finding a Method to Estimate Production Functions of Individual Enterprises on Multiple Enterprise Farms," *Proceedings of the Conference on Resource Productivity and Farms Scale*, Ames: Iowa State College Press, 1955, and Christoph Beringer, *op. cit.*, pp. 28-40.

tions approach for estimating production functions if the investigator is able to obtain enterprise input-output data that indicate with sufficient accuracy the input used and the outputs produced by the individual enterprises.

IV

In order to lend more substance to the conceptual investigations, a series of independent enterprise Cobb-Douglas functions were fitted to data from multiple enterprise farms.

The data were provided by the Department of Agricultural Economics, University of Illinois, where detailed enterprise cost accounts are kept on about 40 to 60 farms annually. The sample chosen consisted of 27 dairy hog farms in the Blackhawk area in northwestern Illinois. The principal crops grown on these farms were hay, oats, and corn. The data covered the calendar year 1950, which was the only year in the recent past for which a reasonably large number of farms with the same enterprise combination kept accounts.

A total of four functions was fitted. Three of these were enterprise functions fitted to data from the dairy, the hog, and the crop enterprise respectively. The fourth was an aggregate function fitted to data from the entire farm. A comparison of enterprise functions with the aggregate function would show if enterprise functions can furnish more meaningful estimates than can be obtained by using one aggregate function. The estimates will be more meaningful if some or all of the MVP estimates of like factors in the individual enterprise functions are significantly different from the estimates obtained in the aggregate function.

The marginal value productivities estimated for the various input or investment categories used in the four functions are presented in Table 1. This interfunctional comparison suggests that the MVP estimates in the aggregate function are weighted averages of the estimates obtained in the individual enterprise functions. As an example one might consider the MVP estimate for labor in the aggregate function which approximates reasonably well the earning of this factor in the dairy and crop enterprises but does not reflect the estimated earning power of labor in the hog enterprise. The same is true for the estimate returns on machinery investment.

Statistical measures other than marginal value productivities also have been calculated and a comparison of the four functions with respect to these quantities is presented in Table 2. In particular these measures are the steepness of the function, determined by the constant "a," the errors around the regression line determined by the standard error of estimate $\bar{S}$, and the amount of variation that is explained by the independent variables, measured by the coefficient of multiple determination $\bar{R}^2$.

TABLE 1. COMPARISON OF MARGINAL VALUE PRODUCTIVITY ESTIMATES FROM THREE ENTERPRISE FUNCTIONS WITH THE CORRESPONDING ESTIMATES OBTAINED FROM AN AGGREGATE FUNCTION*

I Input or Investment Category	II Level	III Hog function	IV Dairy function	V Crop function	VI Aggregate function
Labor (hour)	Mean	.0453	.6867	.7182	.7056
	Upper	.7245	1.1240	1.6449	1.1579
	Lower	−.6338	.2499	−.2078	.2534
Land (acre)	Mean	—	—	34.6680	33.8006
	Upper	—	—	43.8537	49.6626
	Lower	—	—	25.4826	17.9387
Feed (dollar)	Mean	1.0087	1.0187	—	—
	Upper	1.1970	1.2329	—	—
	Lower	.8203	.7478	—	—
Cash expenses (dollar)	Mean	2.6426	−.1407	.4305	1.2965
	Upper	4.7100	1.3532	1.1616	1.7423
	Lower	.5696	−1.6346	−.3006	.8507
Machinery investment (dollar)	Mean	1.3693	.4310	.1830	.2004
	Upper	3.2113	1.1026	.3640	.4481
	Lower	−.4730	−.2407	.0020	−.0473
Livestock investment (dollar)	Mean	−.3443	.0245	—	.3899
	Upper	.2216	.2922	—	.7362
	Lower	−.9103	−.2433	—	.1436
Housing (animal unit)†	Mean	−.0875	24.6796	—	5.1740
	Upper	.4839	49.8100	—	36.1560
	Lower	−.6591	−.4500	—	−25.8085

* MVP estimates are given in dollars per unit of the production factor listed in column I Thus at the geometric mean labor earned $.0453/hour in hogs, $.6867/hour in dairy, etc.

† One "housing animal unit" is defined as the amount of space required to house one mature dairy cow plus replacement and feed supply for one year.

This comparison again shows that the quantities calculated for the aggregate function appear to be a weighted average of the corresponding figures in the individual enterprise functions. The reason why the aggregate function is a weighted rather than a true average of the enterprise functions is that the input quantities used in the dairy enterprises on the

TABLE 2. INTERFUNCTIONAL COMPARISON OF THE CONSTANT "a," STANDARD ERRORS OF ESTIMATES AND COEFFICIENTS OF MULTIPLE CORRELATION AND DETERMINATION

	Hog function	Dairy function	Crop function	Aggregate function
"a" Value in Natural Numbers	11.384000	1.057100	38.260000	1.480000
Standard Error of Estimate $\bar{S}$	.066573	.088679	.080566	.064854
Coefficient of Multiple Correlation $\bar{R}$	.950682	.876584	.825090	.919098
Coefficient of Multiple Determination R^2	.903796	.768400	.680770	.844741

farms included in the sample were considerably larger (in absolute numbers) than the corresponding input quantities used in other enterprises.

The errors of the regression coefficients in Table 1 are very large. A number of factors is considered responsible for these relatively high standard errors: (1) The sample of farms that had to be used for the purposes of this analysis was not purposively chosen and was not controlled with respect to factors such as soil types, climatic factors and market location. Ordinarily when such controls are imposed, one is more certain that farms for which the analysis is made are approximately on the same production function. This in turn contributes to keep the standard errors of the regression coefficients low. (2) The classification of variables employed in this analysis could be improved so that the intercorrelation among independent variables is reduced. High correlation among the independent variables is a factor contributing to high standard errors of estimate.

Although the comparison among the four functions illustrates the usefulness of fitting independent enterprise functions, there are other conclusions not directly evident from the comparison made in Table 1 as follows:

1) Detailed enterprise cost accounts should be kept wherever possible in terms of physical units rather than dollar values in order to avoid the problems that arise in pricing fixed assets.

(2) The accounts should clearly separate productive cash expenses such as seed costs, fertilizer costs, fuel and oil costs, etc. from nonproductive expenses such as taxes, interest, insurance, etc.

(3) The accounts should separate maintenance repairs on machinery and buildings from those repair items that add significantly to the life of the investment item.

(4) In classifying inputs into input categories, perfect or nearly perfect substitutes as well as perfect or nearly perfect complements can be grouped into one category. This procedure will contribute to keep the intercorrelation among the input categories low.

(5) Since production functions for each individual output cannot be estimated outputs must be classified into output categories. In this grouping process those products that are produced in fixed or nearly fixed proportions (i.e. milk and calves, pork and lard, etc.) should be grouped into one category. Enterprises competing for important resources should be treated as separate enterprises and should be analyzed independently. Vertically integrated enterprises such as crops and livestock enterprises should be treated separately, otherwise it is not possible to determine accurately where in the farm business a reallocation of inputs is necessary. During the early stages of this investigation the fitting of only two enter-

prise functions one to dairy and one to hogs, was considered. Crop inputs would have been treated as inputs into the livestock enterprises apportioned according to the amount of home grown feed consumed by each of these livestock enterprises. Later on it was decided to separate these vertically integrated enterprises mainly for analytical reasons. Unless such a separation is made, the best cannot be selected from among a series of possible uses of the crops grown on the farm. If the earning power of feed in the livestock enterprises were not separately estimated, for example, no conclusions could be reached regarding the profitability of selling the crop for cash as compared with marketing it through livestock.

PREDICTING HOG PRICES

CLIFTON B. COX AND PATRICK J. LUBY
Purdue University

THE prediction of free price movement has always been considered a dangerous occupation. The knowledge of future prices is very important to the producer, marketing agency and the consumer. In the livestock and meat industry, such knowledge would influence decisions concerning the breeding, feeding and marketing programs of the producer. Increased knowledge would also be of considerable value to the packer in his problems concerning the buying, selling and storing of meat products. The consumer, with his increased ability to store meat, might also benefit directly from such knowledge of future prices.

Use of regression methods in price analysis was popular a generation ago but fell into considerable disrepute during the price declines of the thirties. Regression analysis was used at that time to correlate price movements with causal and associated factors for the purpose of explaining why prices fluctuated.[1] The model was not specifically formulated to predict price changes since usually the independent variables had to be forecasted before the model could be used for prediction purposes. The same type of analysis, however, by using certain types of data chosen primarily for prediction purposes, can be more useful in forecasting prices.

Past published work in quantitative methods specifically aimed at price prediction has been rather limited. Most effort has been directed at analyzing past price movements.[2] Although this is a necessary step, perfect knowledge of future price changes cannot be known by use of regression analysis or any other quantitative device. The proper use of such tools plus sound economic judgement, however, is better than judgement alone.

Our purpose is to predict hog prices by using information available in advance of the marketing season. In this paper, an attempt has been

[1] E. C. Young, "Relation of the Wholesale Price of Pork to the Price of Hogs," *Journal of Farm Economics*, October, 1931, pp. 644-647.

Indiana Experiment Station Journal Paper 987.

[2] For examples see: Sidney J. Armore, *The Demand and Price Structure for Food Fats and Oils*, U.S.D.A. Tech. Bul. 1068, 1953; C. B. Cox, E. J. Eisenach and M. P. Mitchell, *Beef Cattle Prices*, Purdue Agr. Exp. Sta. Bull. No. 582, January, 1953; Karl A. Fox, "Factors Affecting Farm Income, Farm Prices, and Food Consumption," *Agricultural Economics Research*, July, 1951; Frank A. Pearson and Edmond E. Vial, *Prices of Dairy Products and Other Livestock Products*, Ithaca, New York, 1946; Robert W. Rudd, *An Analysis of Feeder Pig Prices in Central Kentucky*, Kentucky Agr. Exp. Sta. Bul. No. 584, April, 1952; and Geoffrey Shepherd, J. C. Purcell and L. F. Manderscheid, *Economic Analysis of Trends in Beef Cattle and Hog Prices*, Iowa State College, January, 1954.

made to predict the level of prices paid for hogs to farmers in the United States for future time periods of six and twelve months. This was attempted through the use of an old technique, multiple regression analysis, and new types of factors and time periods. For this study on predicting hog prices, a new hog marketing year was developed to fit the farrowings as reported by the U.S. *Pig Crop Report*. The year has been broken into two farrowing seasons by government definition. The spring season includes all pigs farrowed from December 1 through May 31. The government has defined the fall farrowing season as extending from June 1 through November 30. During the time period studied, the average length of time between the farrowing and marketing of hogs was eight months. Since the size of the fall farrowing is associated with the number farrowed the preceding spring,[3] the hog marketing year has been defined in this study to begin August 1, eight months after the start of the farrowing year. The marketing year was then broken down into two seasons. The fall season for marketing spring-farrowed hogs extends from August 1 through January 31. The spring season for fall-farrowed hogs begins February 1 and ends July 31.

The time period studied included the eleven prewar years from August, 1931 through July, 1942, and the five postwar years from August, 1947 through July, 1952. The war years were omitted since government price-control regulation did not permit prices to react freely to changing production and income levels during that time. The 16 years studied included several price depressions and inflations of varying magnitude and extended over several complete hog production cycles.

In analyzing the relationships among hog prices and other factors, the data were converted to percentages of the corresponding period of the preceding year. This conversion was made to facilitate calculation and later application.

Three estimating equations were developed, one for average annual prices and one for each of the six-month marketing periods. One equation can be used to estimate the price of hogs for the marketing year (August-July). Another equation is to be utilized to predict the price of hogs for the fall period (August-January). Both of these estimates can be made about the first of August. The third equation allows one to predict the price level for hogs for the spring period (February-July), at the beginning of the spring season.

Seven of the nine different factors in the three regression equations are known before the time period in which the price is to be predicted. Two must be predicted before they can be substituted into the predic-

[3] R. L. Kohls and Don Paarlberg, *The Short Time Responses of Agricultural Productions to Price and Other Factors*, Purdue Agr. Exp. Sta. Bul. 555, October, 1950.

tion formula: (1) consumer disposable income from July through the following June, as a percentage of the preceding twelve months, which is needed in August for the annual market year forecast, and (2) disposable income for the last two quarters of the year as a percentage of the corresponding two quarters of the preceding year for use in the fall (August-January) prediction. The prediction for the last two quarters is not considered to be an important handicap to the prognosticator since by August he should have a good estimate of the change in income during the next five months as compared with the previous year. However, the August estimate of income for the following eleven months is more difficult. The other seven factors used are all known prior to or within a few days after the beginning of the time period to be predicted.

Prediction of Annual August-July Hog Price Changes

Three factors were used to estimate marketing-year hog prices, consumer disposable income, pigs saved and corn crop. Consumer disposable income during the last two quarters of the year in which the forecast is made and the first two quarters of the next year, as a percentage of disposable income during the twelve preceding months, must be predicted at the beginning of the marketing year (August). This factor is used as a measure of changes in consumer demand during the year in which the prices are estimated. In the development of the equation, use was made of an ex post estimate published by the Department of Commerce. To measure probable changes in supply, use was made of the factors of pigs saved of the preceding spring crop (December-May) as a percentage of the preceding spring crop. The government estimate of this figure is published June 22, about six weeks before the beginning of the marketing year. The third factor employed was corn production of the same year, in which the forecast is made as a percentage of the preceding year's crop. Government estimates of this figure are released the tenth of each month. In most years estimates as of August 1 and released August 10 are good estimates of the final yield.[4]

Three variables, changes in disposable income (X_2), changes in pigs saved of the spring crop (X_3), and changes in corn production (X_4), were associated with 89 percent of the changes in the annual marketing year average price of hogs. Pigs saved of the spring crop was the most important in being associated with changes in hog prices. Changes in consumer disposable income was second in importance (Table 1).

From the standard error of estimate, one might expect the difference between the predicted and actual price to be less than 11.2 percent in

[4] Malcolm Clough, "Changes in Corn Acreage and Production After Early Indications," *Agricultural Economics Research*, October, 1951.

TABLE 1. SELECTED FACTORS ASSOCIATED WITH CHANGES IN AVERAGE MARKETING YEAR (AUGUST–JULY) HOG PRICES, UNITED STATES, 1931–1942 AND 1947–1952

Factor[a]	r^2 li.jkl	Partial (net) regression coefficient	Standard error of the regression coefficient	"Beta" value
X_2 Disposable income[b]	.69[d]	+1.51	.29	+.52
X_3 Pigs saved of the preceding spring crop[c]	.81[d]	−1.84	.26	−.71
X_4 Corn production during same year	.43[e]	− .34	.11	−.32

[a] All factors expressed as a percentage of preceding year.
[b] July through June, same year.
[c] December through May.
[d] Significant at the 99 percent level.
[e] Significant at the 95 percent level.
Regression equation:

$$X_1 = 1.5080\ X_2 - 1.8417\ X_3 - .3354\ X_4 + 170.9258\ R^2\ 1.234 = .89$$

about 68 percent of the years if the equations were used to forecast levels of hog prices. Although the time period studied is admittingly a poor test of the value of the equation, the equation would have missed the actual annual price level of hogs by only an average of 8.6 percent (Figure 1), and would have predicted the average price within 15 percent of the actual level in 15 of the 16 years.

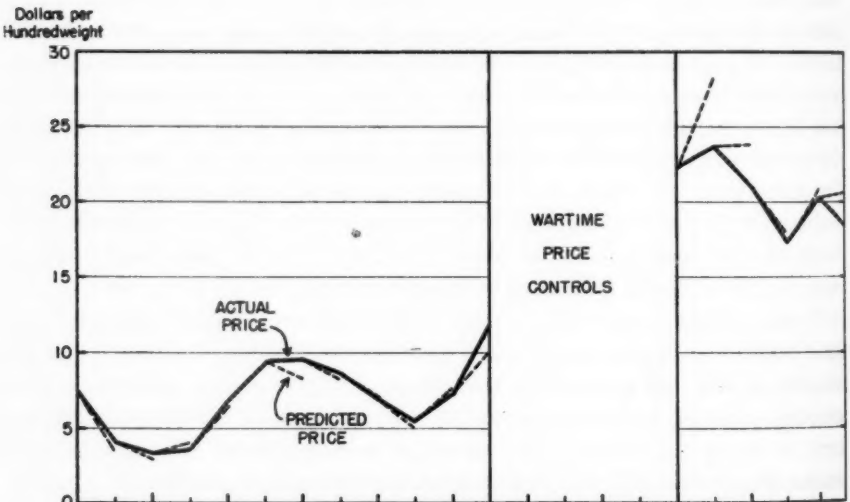


FIG. 1. ACTUAL AND CALCULATED AUGUST-JULY AVERAGE PRICE OF HOGS IN THE UNITED STATES, 1931-1942 AND 1947-1952. Note: Actual and calculated prices during the 1935-36 marketing year were the same.

Prediction of August-January Hog Price Changes

Four significant factors were found to be of value in predicting the price level for hogs during August to January. These included (1) average consumer disposable income from July through December as a percentage of the same period of the preceding year. This must be estimated. A very good estimate of this can be made by August since most of the change in income, if there is any, will already have occurred by that time; or some indication of any change in the next few months will probably be known. Other variables used were (2) pigs saved of the spring crop (December-May) as a percentage of the preceding spring crop, (3) cold storage holdings on August 1 as a percentage of the preceding August 1, and (4) the average price paid to farmers for hogs in July as a percentage of the preceding July. Factors 2, 3 and 4 are known on or within a few days after August 1, the beginning of the fall hog-marketing season. Three other factors, the July price of fats and oils, corn production of the same fall, and the August 1 price of lard proved not to be significantly associated with the fall price of hogs after changes in the significant variables were eliminated.

The four variables, changes in disposable income (X_2), changes in pigs saved of the spring crop (X_3), changes in total cold storage holdings of pork on August 1 (X_4), and changes in the average July price of hogs (X_5), were associated with 92 percent of the changes in the fall (August-January) average price of hogs. The factor of changes in disposable income was by far the most closely associated with the price changes for fall hogs. Pigs saved of the spring crop was second in importance (Table 2).

TABLE 2. SELECTED FACTORS ASSOCIATED WITH CHANGES IN AVERAGE FALL (AUGUST–JANUARY) HOG PRICES, UNITED STATES, 1931–42, AND 1947–52

Factor[a]	r^2 li.jkl	Partial (net) regression coefficient	Standard error of the regression coefficient	"Beta" value
X_2 Disposable income[b]	.66[d]	+1.70	.37	+.59
X_3 Pigs saved, preceding spring crop[c]	.55[d]	− .96	.26	−.37
X_4 Total cold storage holdings of pork, August 1	.34[e]	− .35	.15	−.24
X_5 Average July price of hogs	.25[f]	+ .23	.12	+.26

[a] All factors expressed as a percentage of preceding year.
[b] July through December.
[c] December through May.
[d] Significant at the 99 percent level.
[e] Significant at the 95 percent level.
[f] Significant at the 90 percent level.
Regression equation:

$$X_1 = 1.6972\ X_2 - .9630\ X_3 - .3490\ X_4 + .2299\ X_5 + 37.8402\ R^2\ 1.2345 = .92$$

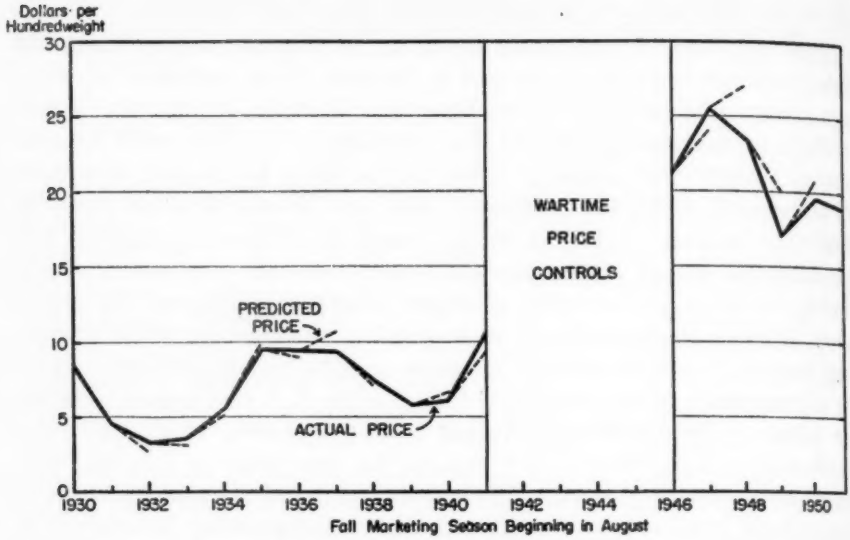


FIG. 2. ACTUAL AND CALCULATED AUGUST-JANUARY AVERAGE PRICE OF HOGS, UNITED STATES, 1931-1942, AND 1947-1952. Note: Actual and calculated prices during the fall of 1931 and 1938 were equal.

According to the standard error of estimate one could expect the actual average of fall prices to differ from the calculated price by less than 9.4 percent in about 68 percent of the years. During the time period studied, the predicted price differed by an average of 8.1 percent from the actual level, differing by less than 10 percent in 12 of the 16 years (Figure 2).

Prediction of February-July Hog Price Changes

Changes in the January average price of hogs from the preceding year was the only factor that was closely associated with changes in the price of hogs in the spring (February-July). Changes in this factor alone were associated with 88 percent of the spring price changes. Pigs saved of the fall crop (June-November), as a percentage of the preceding fall crop; and cold storage holdings of pork on February 1, as a percentage of the preceding February 1, appeared to be important, but were not statistically significant at the 95 percent level. These three factors combined were associated with 91 percent of the changes in the spring price of hogs (Table 3). Changes in the three variables used in the estimating equation are known on or a few days after February 1, the beginning of the spring marketing season.

The close association of changes in the January price of hogs with

TABLE 3. SELECTED FACTORS ASSOCIATED WITH CHANGES IN AVERAGE SPRING (FEBRUARY-JULY) HOG PRICES, UNITED STATES, 1931–42 AND 1947–52

Factor[a]	r^2 li.jkl	Partial (net) regression coefficient	Standard error of the regression coefficient	"Beta" value
X_2 Average January price of hogs	.83[c]	+.80	.11	+.85
X_3 Pigs saved, preceding fall crop[b]	.13[d]	−.38	.28	−.15
X_4 Total cold storage holdings of pork, February 1	.14[d]	−.18	.13	−.13

[a] All factors expressed as a percentage of preceding year.
[b] June through November, preceding year.
[c] Highly significant.
[d] Not significant at the 95 percent level.
Regression equation:

$$X_1 = .8014\ X_2 - .3761\ X_3 - .1849\ X_4 + 81.6108\ R^2\ 1.234 = .91$$

changes in the spring average leads to the conclusion that change in the general level of hog prices occurs in the fall, and the spring level is usually determined before January. Although variation in monthly hog prices indexes appeared to be as pronounced in the spring as in the fall, this variation was around an already determined level rather than the result of a change in levels.

The spring price estimate could be expected to be within 12.5 percent of the actual level in about two-thirds of the years. During the 16 years studied, the price forecasted by the equation would have differed from the actual price by an average of 9.3 percent (Figure 3).

Further Evaluation of the Forecasts

During the 16 years studied, only nine (three annual and three of each seasonal) of the 48 forecasts failed to forecast the correct direction of price movement. In these nine time periods, the price changed from one to eleven percent in the opposite direction from that forecasted, averaging 5.9 percent. The error reduction score,[5] which is the average of percentage price changes from the preceding time periods minus the average of the percentage errors in forecasting divided by the average percentage price changes, reduced the marketing year error by 65.9 percent. The fall marketing season error was reduced by 68.2 percent and the spring error was reduced by 65.9 percent. The equations were more accurate when the price change from the preceding year was large. In the 23 time periods, when the price fluctuated by 18.5 percent to 129.0 percent from the preceding year, the calculated price differed from the

[5] John D. Baker, Jr., and Don Paarlberg, "Outlook Evaluation, Methods and Results," *Agricultural Economics Research*, October, 1952, pp. 105-114.

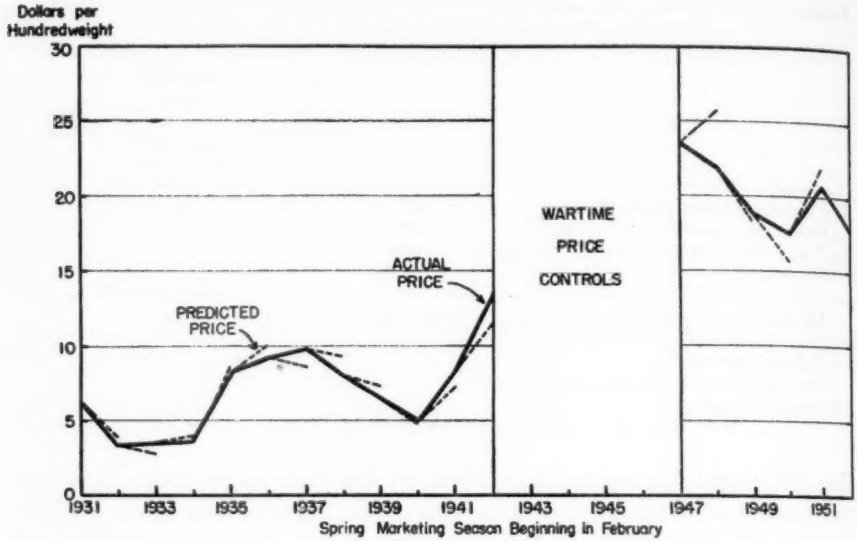


FIG. 3. ACTUAL AND CALCULATED FEBRUARY-JULY AVERAGE PRICE OF HOGS, UNITED STATES, 1932-1942 AND 1948-1952. Note: Actual and calculated prices during the spring of 1952 were equal.

actual price by less than an average of 7.1 percent. In the 25 time periods, when the price fluctuated less than 18.5 percent, the calculated price differed from the actual level by an average of 10.1 percent.

Conclusion

Forecasts of changes in the seasonal level of hog prices in the United States can be applied to a specific market and to specific weight classes. This can be accomplished through the use of monthly indexes of prices for the different markets and weight classes involved. By using only the predicted seasonal price change and average monthly price indexes during the five postwar years from August, 1947 through July, 1952, the calculated predictions would have differed from the actual monthly price by an average of 10.5 percent for the United States average and by an average of 11.1 percent for four selected weight classes of hogs at the Indianapolis market. Not all of the error in monthly predictions is the result of error in forecasting changes in the seasonal price level. Had the average six-months seasonal price been correctly predicted in all five years, only about 56 to 57 percent of the percentage error in monthly predictions would have been eliminated. The error still remaining was largely due to changes in the seasonal pattern from year to year. This error averaged 4.6 percent for the United States average and 4.7

percent for the four weight classes of hogs at the Indianapolis market.

In the fall months, the average error decreased steadily until November and then rose sharply again through January. Changes in the level of hog prices seem to occur in the fall months and the movement through these months tends upward or downward, depending largely upon changes in income level and slaughter numbers, and therefore generally deviates from the average seasonal pattern. This change in the level of prices is usually accomplished by January. Although the monthly prices in the spring vary just as widely as in the fall months the spring prices tend to fluctuate around a level already established.

A MODIFIED SIMPLEX SOLUTION FOR LINEAR PROGRAMMING WITH VARIABLE CAPITAL RESTRICTIONS*[1]

WILFRED CANDLER[2]
Iowa State College

LINEAR programming is becoming a widespread and useful tool in economic guidance. However, possibilities still exist for increasing the flexibility in application of the method to a wider range of situations, and in lessening time or cost of computations. This paper reports a method whereby linear program solutions can be provided easily for a large number of capital situations. The results can be presented in a simple manner for use by extension personnel, or by farmers themselves. Most farmers have limited amounts of capital at their command. Hence, the capital restriction used for one programming situation does not apply to another farm with more or less capital available. In many farming regions, a large number of farms have similar soil, acreage, building and family labor restrictions, whereas capital is highly variable. Many previous programming studies have attempted to meet this problem by computing programs for a few discrete capital levels, such as $5,000, $10,000, etc. However, the method proposed here allows capital to be a continuous variable and hence can replace a number of discrete solutions. It derives the optimum production plan "continuously" *for each and every level of capital;* not merely for discrete, arbitrary levels.

Basic Principles

The modified simplex solution rests on two simple conditions: First, the optimum program for each situation is one that gives the highest ratio of income to limiting resources, (i.e., the income-resource ratio for *each* limitational resource is higher than could be provided by any other program). Second, a simplex solution can be derived whereby each new

* Journal paper J-2935 of the Iowa Agricultural Experiment Station, Ames, Iowa, Project 1135.

[1] In this article it is assumed that the reader is already acquainted with the general principles of linear programming, at least to the level contained in E. O. Heady's "Simplified Presentation and Logical Aspects of Linear Programming Technique," *Journal of Farm Economics,* Vol. XXXVI, No. 5, Dec., 1954. It should also be explained that no attempt has been made to use short-cut methods of computation, because it is assumed that anyone who uses short-cut methods will be able to adapt the outline given here. On the other hand, short-cut methods might obscure the argument for less sophisticated linear programmers.

[2] The author wishes to acknowledge the valuable criticism of Professor E. O. Heady, J. Dean and L. Loftsgard who pointed out many ambiguities in the original presentation.

activity introduced gives a return to capital (increase in income per unit of capital used) higher than any other activity that could have been introduced; this means that the ratio of total income to total capital used is higher than for any other program. When the supply of capital is exhausted (a) capital becomes a limiting resource and (b) the ratio of total income to total capital used is at a maximum and the resulting program is optimum. In addition, the marginal earnings of capital are higher than for any other program consistent with condition (b). The important point is that if each new activity gives the highest possible return to capital consistent with past plans, then the earnings of each additional dollar are the highest feasible, and the total earnings of total capital are a maximum.

A Simple Example

The method under consideration will first be applied to a simple example.

The example[3] is said to be "simple" because *none of the input-output coefficients are negative* (i.e., we do not have a product-resource such as feed, which can be purchased and processed, or raised and sold). This condition permits a small modification of the simplex solution to give the derivation of "the optimum program for each and every level of capital." A special case is presented first, followed by the general case, to facilitate grasp of the logic by the reader.

Standard simplex rules are: "bring in the activity with the most negative z_j-c_j;" "The outgoing row is the row with the smallest 'R'."[4] For the simple example, the first of these rules is replaced with: "before deciding which of the negative z_j-c_j's to bring in, divide each z_j-c_j by the corresponding coefficient in the capital row; the most negative of the resulting figures defines the activity which should be brought in." This new "decision row" has been designated the "d_j" row. The d_j coefficients are defined as $d_j = z_j\text{-}c_j/a_j$, where $z_j\text{-}c_j < 0$, and a_j, the coefficient in the capital row, is positive. For the simple example there is no need to calculate a special ratio where the z_j-c_j coefficient is zero or positive. The second rule becomes: "Ignore the capital row when finding the outgoing row (row with the smallest 'R')."

Table 1 is the solution of Heady's example[5] using the modified simplex

[3] This example is based on Heady, *loc. cit.* However, the capital input-output coefficient for oats has been changed from .25 to .20 to prevent two activities having the same return to capital. The ΔP_o column will be explained in connection with the "typical" example, and indicates why the "simple" example is a special case.

[4] See Heady, *ibid.*, and A. Charnes, W. W. Cooper and A. Henderson, *An Introduction to Linear Programming*, John Wiley and Son, 1953.

[5] Heady, *ibid.*, p. 1043.

TABLE 1. A SIMPLE EXAMPLE

Resource		P_0	ΔP_0	P_4	P_5	P_6	P_7	P_8	Corn 1.50 P_1	Potatoes 2.00 P_2	Oats .75 P_3	R	Section
Capital	P_4	0	0	1	0	0	0	0	.50	.80	.20		
Land	P_5	100	—	0	1	0	0	0	.02	.01	.025	4,000	
March-Labor←P_6		190	—	0	0	1	0	0	0	.03	.05	3,800	1
April Labor	P_7	200	—	0	0	0	1	0	0	.04	0	Unlim.	
May Labor	P_8	120	—	0	0	0	0	1	.06	0	0	Unlim.	
	z_j	0	0	0	0	0	0	0	0	0	0		
	$z_j - c_j$	0	0	0	0	0	0	0	−1.50	−2.00	− .75		
	d_j	0	0	0	0	0	0	0	−3.00	−2.50	−3.75		
	P_4	− 760.000	− 760.000	1	0	− 4.000	0	0	.500	.680	0		
	←P_5	5.000	—	0	1	− .500	0	0	.020	− .005	0	250	
.75	→P_3	3800.000	—	0	0	20.000	0	0	0	.600	1	Unlim.	2
	P_7	200.000	—	0	0	0	1	0	0	.040	0	Unlim.	
	P_8	120.000	—	0	0	0	0	1	.060	0	0	2,000	
	z_j	2850.000	2850.000	0	0	15.000	0	0	0	.450	.750		
	$z_j - c_j$	2850.000	2850.000	0	0	15.000	0	0	−1.500	−1.550	0		
	d_j		− 3.750						−3.000	−2.279			
	P_4	− 885.000	− 125.000	1	−25.000	8.500	0	0	0	.805	0		
1.50	→P_1	250.000	—	0	50.000	−25.000	0	0	1	− .250	0	Unlim.	
.75	P_3	3800.000	—	0	0	20.000	0	0	0	.600	1	190	3
	P_7	200.000	—	0	0	0	1	0	0	.040	0	Unlim.	
	←P_8	105.000	—	0	− 3.000	1.500	0	1	0	.015	0	70	
	z_j	3225.000	375.000	0	75.000	−22.500	0	0	1.500	.075	.075		
	$z_j - c_j$	3225.000	375.000	0	75.000	−22.500	0	0	0	−1.925	0		
	d_j		− 3.000			− 2.647				−2.391			

TABLE 1.—*Continued*

Resource		P_0	ΔP_0	P_4	P_5	P_6	P_7	P_8	Corn 1.50 P_1	Potatoes 2.00 P_2	Oates .75 P_3	R	Section
	P_4	−1480.000	− 595.000	1	− 8.000	0	0	− 5.667	0	.720	0		
1.50	P_1	2000.000	—	0	0	0	0	16.667	1	0	0	Unlim.	
.75	P_3	2400.000	—	0	40.000	0	0	−13.333	0	.400	1	6,000	4
	←P_7	200.000	—	0	0	0	1	0	0	**.040**	0	5,000	
	→P_6	70.000	—	0	− 2.000	1	0	.667	0	.010	0	7,000	
	z_j	4800.000	1575.000	0	30.000	0	0	15.000	1.500	.300	.750		
	z_j-c_j	4800.000	1575.000	0	30.000	0	0	15.000	0	**−1.700**	0		
	d_j		− 2.647							**−2.361**			
	P_4	−5080.000	−3600.000	1	− 8.000	0	−18.000	− 5.667	0	0	0		
1.50	P_1	2000.000	—	0	0	0	0	16.667	1	0	0		
.75	P_3	400.000	—	0	40.000	0	−10.000	−13.333	0	0	1		5
2.00	→P_2	5000.000	—	0	0	0	25.000	0	0	1	0		
	P_6	20.000	—	0	− 2.000	1	− .250	.667	0	0	0		
	z_j	13300.000	8500.000	0	30.000	0	42.500	15.000	1.500	2.000	.750		
	z_j-c_j	13300.000	8500.000	0	30.000	0	42.500	15.000	0	0	0		
	d_j		− 2.361										

UNIVERSITY OF MICHIGAN LIBRARIES

solution. The original supply of capital is zero; the supply becomes successively more negative as the solution proceeds. The absolute magnitude of this negative capital supply corresponds to the amount of capital that is necessary if the program is to be feasible.[6]

In section 1 of Table 1 the most negative d_j is -3.75,[7] in the P_3 ("Oat") column. The modified rule indicates that P_3 is the incoming row. The smallest R, ignoring capital, is 3,800 in the P_6 ("March Labor") row; P_6 is the outgoing row.

In section 2 of Table 1, the capital supply or the P_0 column is calculated in the conventional way, i.e., $0 - 3{,}800 \times 0.20 = -760$. Given \$760 of capital the production of 3,800 bushels of oats would be feasible and the argument given above would read: (a) capital is a limiting resource, (b) the ratio of total income to total capital used is at a maximum,[8] and the resulting program (3,800 bushels oats) is optimum. This can be checked by the conventional simplex method using a capital supply of \$760.

In section 2 of Table 1, the most negative d_j is -3.00 in the P_1 column; the incoming row for section 3 is P_1. The smallest R is 250 and thus P_5 is the outgoing row. The remainder of the example is computed in a similar manner, i.e., the most negative d_j in section 3 defines the incoming activity for section 4, etc.

In section 5 none of the z_j-c_j's are negative and, therefore, this is the optimum program for "unlimited capital." For any problem where there is more than \$5,080 available, the surplus goes into the "capital disposal" activity. The optimum program checks with that given in Heady's article; 400 bushels oats, 2,000 bushels corn, and 5,000 bushels potatoes, which also corresponded to "unlimited" capital.[9]

Table 2 summarizes the programs given by the successive iterations of Table 1. Section 1 represents the trivial "optimum" plan where the farmer has zero capital, zero output and zero income.

Graphical Presentation of Results

The data in Table 2 may be presented graphically, as in Figure 1, with capital supply measured along the horizontal axis, and income and

[6] A feasible program is one which does not call for more resources than are available.

[7] $d_j = z_j - c_j/a_j = -.75/.20 = -3.75$.

[8] Since d_3 in section 1 (-3.75) is more negative than any other d_j, *each* dollar invested in P_3 yields a higher income than could be obtained by investment elsewhere.

[9] Heady's example uses \$5,100 to attain this program; the discrepancy between the two solutions is due to the changed capital-oats input-output coefficient which was noted in footnote 2.

the various amounts of each activity measured vertically. Since the relation between resources and activities is linear, the points representing successive capital optima[10] may be joined by straight lines. These lines give the optimum program for amounts of capital between capital optima points. Thus, the optimum program for a farmer with $4,000 of capital is given by the intersection of a vertical line through $4,000 on the horizontal axis, and the lines connecting the programs of capital optima 4

TABLE 2. SUMMARY OF THE PROGRAMS OBTAINED IN TABLE 1

Capital Optimum	Capital Needed	Bushel Oats	Bushel Corn	Bushel Potatoes	Income $
1	0	0	0	0	0
2	760	3,800	0	0	2,850
3	885	3,800	250	0	3,225
4	1,480	2,400	2,000	0	4,800
5	5,080	400	2,000	5,000	13,300

and 5. Specifically, a farmer with $4,000 capital should produce 3,500 bushels of potatoes, 2,000 bushels of corn and 800 bushels of oats. Such a plan would result in an income of $10,800.

Figure 1 indicates that the first dollar of available capital permits five bushels of oats to be produced, giving an income of $3.75. Each additional dollar, up to $760, similarly adds $3.75 to total income by the production of an extra five bushels of oats. Production of oats beyond 3,800 bushels is prevented by a shortage of March labor. Additional funds are now used to produce corn. This leads to a fall in the marginal productivity of capital from $3.75 to $3.00 per dollar invested. Corn production continues to expand at a constant rate until land is limiting at $885 of capital. Further expansion of corn output takes place at the expense of oats. With $885 in capital, an additional dollar results in an increase in corn and a decrease in oat production. The reader will be able to follow the further implications of the solution. At $5,080 of capital, additional capital supplies will not increase income.

If the programs "between capital optima" are required with greater accuracy, than can be obtained from a graph, the equations of the lines connecting successive sections can be obtained since the optima represent "two points on the same straight line." The capital-income curve in Figure 1 is "concave from below" indicating, as would be expected, diminishing marginal productivity of capital.

[10] Each of the iterations of Table 1 represents a "capital optimum." The exact implications of this term will be explained later.

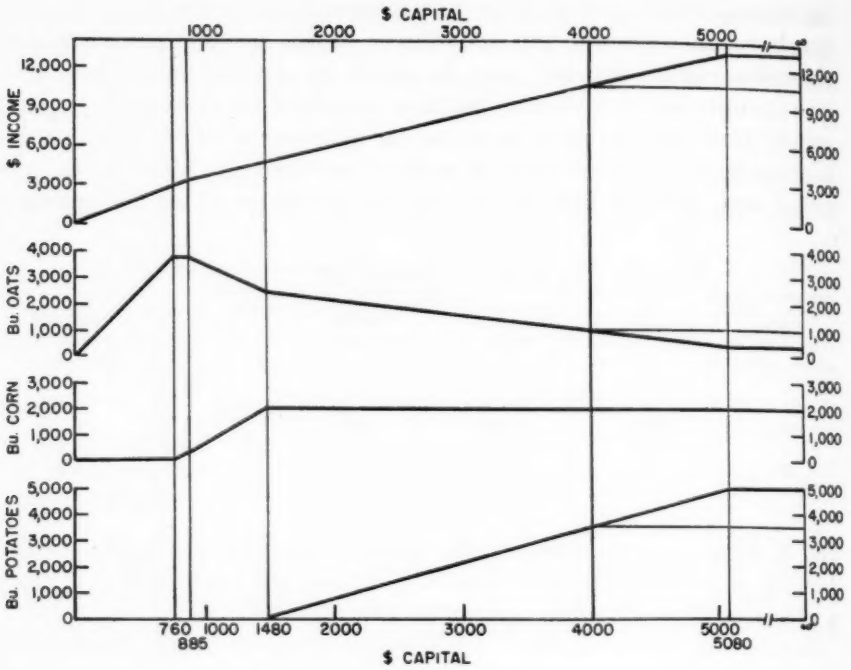


FIG. 1

A More Complicated Example

Production economists are now interested predominately in programming which includes *negative* input-output coefficients.[11] Although it is still possible to obtain a "continuous" simplex solution in this case, some of the simplex iterations represent sub-optimum programs. Negative input-output coefficients occur when the introduction of an activity *increases* the supply of the resources concerned. Thus, if feeds restrict livestock production, introduction of a rotation activity will increase the supply of the various feeds if a negative feed-grain rotation coefficient is used for the rotation. Similarly, if a livestock activity increases the supply of manure that can be used on a rotation, this is indicated by a negative manure-livestock coefficient and a positive manure-rotation

[11] See G. A. Peterson, "Selection of Maximum Profit Combinations of Livestock Enterprises and Crop Rotations," *Journal of Farm Economics*, Vol. XXXVII, 1955, p. 546, Earl R. Swanson, "Integrating Crop and Livestock Activities in Farm Management Activity Analysis," *Journal of Farm Economics*, Vol. XXXVII, No. 5, p. 1249 and Loftsgard, Laurel, Optimum Farm Plans for Beginning Farmers on Carrington-Clyde Soils, Iowa Agr. Exp. Sta. Res. Bul. (in process).

coefficient. Table 3 indicates the "continuous" solution of a "typical"[12] linear programming problem. Essentially, it consists of a rotation that uses manure, a rotation that does not use manure, and a livestock activity that supplies manure and uses the feed produced by the rotations. The zeros in the P_o column opposite Feed Grain, Hay and Manure indicate that the farmer is assumed to start with zero supply of these resources; before an activity can consume these resources another activity must be introduced to produce them. These same general considerations apply where capital and labor can be purchased in the market to increase the initial farm supply.

In Table 3 the optimum program for a small supply of capital includes the number of livestock consistent with the use of some capital on rotations that supply the feed grain and hay consumed by the livestock. Each step (section, iteration) of the simplex solution introduces one, and only one, activity. Hence, if the first optimum program consists of more than one activity, there will be at least one step in the simplex solution that corresponds to a sub-optimum program.

We have seen that so long as programs correspond to a change in the productivity of capital are known, all the intermediate programs can be obtained. To distinguish these special optima, (i.e., the optimum programs where the productivity of capital changes) they are called "capital optima."[13] The problem is how to compute the capital optima for the "typical" example. The principles involved are illustrated in figures 2 and 3. The vertical axis measures income, while the supply of capital is measured horizontally. Any straight line through the origin represents a constant income-capital ratio. Thus, in Figure 2 any point on OP represents the same income-capital ratio. A point lying above OP represents a higher income-capital ratio than OP, and similarly a point below OP represents a lower income-capital ratio. The point P represents the first capital optimum program, hence, OP has a steeper slope than any other

[12] This example has been constructed simply to illustrate the possible relationships that may be found in the process of obtaining successive capital optima. Names have been attached to the activities and restrictions, but only for the purpose of illustrating the general interpretation of the linear programming model being considered. No empirical significance should be attached to the figure selected or results obtained. It might appear from Table 3 that there is some danger of double counting the value of crops produced, once in the net revenue of the rotations and a second time in the net revenue of the livestock activities. However, this has been avoided since we assume crops are valued at market prices both for rotation and livestock activities. The crops produced contribute to net revenue from the rotations, and crops consumed are taken as one of the costs of livestock production. This makes net revenue from livestock production less than gross revenue.

[13] All the programs obtained in Table 1 are capital optima, and for this reason it has been referred to as a "simple" example.

TABLE 3. A TYPICAL EXAMPLE

									Livestock Rotation A 21	*Rotation B* 10	32		
		P_0	ΔP_0	P_4	P_5	P_6	P_7	P_8	P_1	P_2	P_3	R	Section
Capital	P_4	0	0	1	0	0	0	0	22	20	37		
Building Space	P_5	100	—	0	1	0	0	0	10	0	10	Unlim.	
Labor	$\leftarrow P_6$	100	—	0	0	1	0	0	1	**10**	1	10	
Corn	P_7	0	—	0	0	0	1	0	4	−10	− 6	Unlim.	
Manure	P_8	0	—	0	0	0	0	1	−10	0	40	Unlim.	1
*	z_j	0	0	0	0	0	0	0	0	0	0		
	$z_j - c_j$	0	0	0	0	0	0	0	−21	**−10**	−32		
	d_j								− .954	− **.500**	− .865		
	e_j												
	f_j												
	P_4	−200.000	−200.000	1	0	−2.000	0	0	20.000	0	35.000		
	$\leftarrow P_5$	100.000	—	0	1	0	0	0	**10.000**	0	10.000	10	
10	$\rightarrow P_2$	10.000	—	0	0	.100	0	0	.100	1	.100	100	
	P_7	100.000	—	0	0	1.000	1	0	5.000	0	− 5.000	20	
	P_8	0	—	0	0	0	0	1	−10.000	0	40.000	Unlim.	2
	z_j	100.000	100.000	0	0	1.000	0	0	1.000	10.000	1.000		
	$z_j - c_j$	100.000	100.000	0	0	1.000	0	0	**−20.000**	0	−31.000		
	d_j		− .500						**− 1.000**		− .886		
	e_j		—										
	f_j		− 2.000			−2.000							
	P_4	−400.000	−400.000	1	−2.000	−2.000	0	0	0	0	15.000		
21	$\rightarrow P_1$	10.000	—	0	.100	0	0	0	1	0	1	Unlim.	
10	P_2	9.000	—	0	− .010	.100	0	0	0	1	0	90	
	$\leftarrow P_7$	50.000	—	0	− .500	**.100**	1	0	0	0	−10	50	
	P_8	100.000	—	0	1.000	0	0	1	0	0	50.000	Unlim.	3
	z_j	300.000	300.000	0	2.000	1.000	0	0	21.000	10.000	21.000		
	$z_j - c_j$	300.000	300.000	0	2.000	**1.000**	0	0	0	0	−11.000		
	d_j		− .750								− .733		
	e_j		—										
	f_j		− 1.333		−1.000	**−2.000**							

TABLE 3.—*Continued*

									Livestock Rotation A Roiation B 21	10	32		Sec-
		P_0	ΔP_0	P_4	P_5	P_6	P_7	P_8	P_1	P_2	P_3	R	tion
	P_4	−300.000	−300.000	1	−3.000	0	2.000	0	0	0	− 5.000		
21	P_2	10.000	—	0	.100	0	0	0	1	0	1	10	
10	P_1	4.000	—	0	.040	0	− .100	0	0	1	1.000	4	
	→P_6	50.000	—	0	− .500	1	1	0	0	0	−10	Unlim.	
	←P_8	100.000	—	0	1.000	0	0	1	0	0	**50.000**	2	4
	z_j	250.000	250.000	0	2.500	0	−1.000	0	21.000	10.000	31.000		
	z_j-c_j	250.000	250.000	0	2.500	0	−1.000	0	0	0	**− 1.000**		
	d_j		− .833				− .500						
	e_j		—								**.200**		
	f_j		− 1.200		−1.200								
	P_4	−290.000	−290.000	1	−2.900	0	2.000	.100	0	0	0		
21	P_1	8.000	—	0	.080	0	0	− .020	1	0	0	Unlim.	
10	P_2	2.000	—	0	.020	0	− .100	− .020	0	1	0	Unlim.	
	←P_6	70.000	—	0	− .300	1	**1**	.200	0	0	0	70	
32	→P_3	2.000	—	0	.020	0	0	.020	0	0	1	Unlim.	5
*	z_j	252.000	252.000	0	2.520	0	−1.000	.020	21.000	10.000	32.000		
	z_j-c_j	252.000	252.000	0	2.520	0	**−1.000**	.020	0	0	0		
	d_j		− .869				**− .500**						
	e_j		—										
	f_j		− 1.151		−1.151								
	P_4	−430.000	−140.000	1	−2.300	−2.000	0	− .300	0	0	0		
21	P_1	8.000	—	0	.080	0	0	− .020	1	0	0		
10	P_2	9.000	—	0	− .010	.100	1	0	0	1	0		
	→P_7	70.000	—	0	− .300	1	0	.200	0	0	0		
32	P_3	2.000	—	0	.020	0	0	.020	0	0	1		6
*	z_j	322.000	70.000	0	2.220	1.000	0	.220	21.000	10.000	32.000		
	z_j-c_j	322.000	70.000	0	2.220	1.000	0	.220	0	0	0		
	d_j		− .500										
	e_j		—										
	f_j		− 2.000		−1.036	−2.000		−1.364					

feasible program. Points P_a, P_b and P_c in Figure 2 indicate capital-income combinations resulting from the first step of the simplex solution. Since the simplex solution has been restricted to feasible programs,[14] the first step of the solution must lie between OP and the horizontal (capital) axis. A movement from this first step to the capital optimum must involve either a decrease in income and a decrease in capital (Fig. 2a), an in-

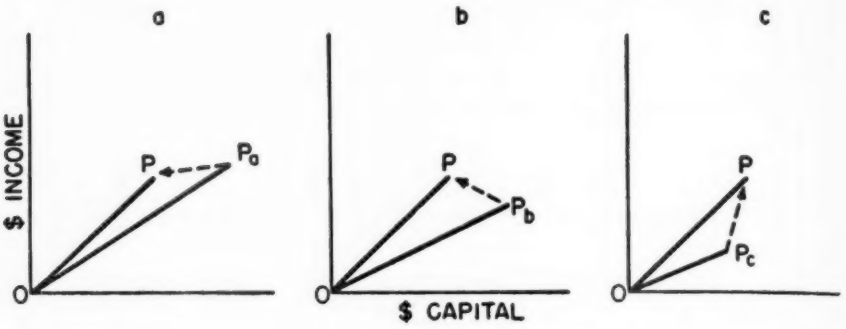


FIG. 2

crease in income and decrease in capital (Fig. 2b) or, finally, an increase in income and an increase in capital (Fig. 2c).

After the first step of the simplex solution the introduction of another activity will result in one of six possibilities:[15]

(a) a decrease in income and capital, but a higher ratio of income to capital than was given by the first step.

(b) an increase in income and a decrease in capital,

(c) an increase in income and capital and a higher ratio of income to capital than was given by the first step,

(d) a decrease in income and capital, and a lower ratio of income to capital than was given by the first step,

(e) a decrease in income and an increase in capital,

(f) an increase in income and capital and a lower ratio of income to capital than was given by the first step.

These possibilities are illustrated respectively by figures 3a through 3f. The introduction of an activity fulfilling conditions a, b, or c results in

[14] Non-feasible programs may be included in the solution by permitting the "supplies" of resources or products in the P_o column to "go negative." However, since some readers might require a special section to convince them that this is legitimate, the method has not been used in this article.

[15] Strictly there are ten possibilities; the four not discussed are an increase or decrease in capital with income unchanged, and an increase or decrease in income with capital unchanged. The reader will have no difficulty in extending the argument given to cover these rare cases.

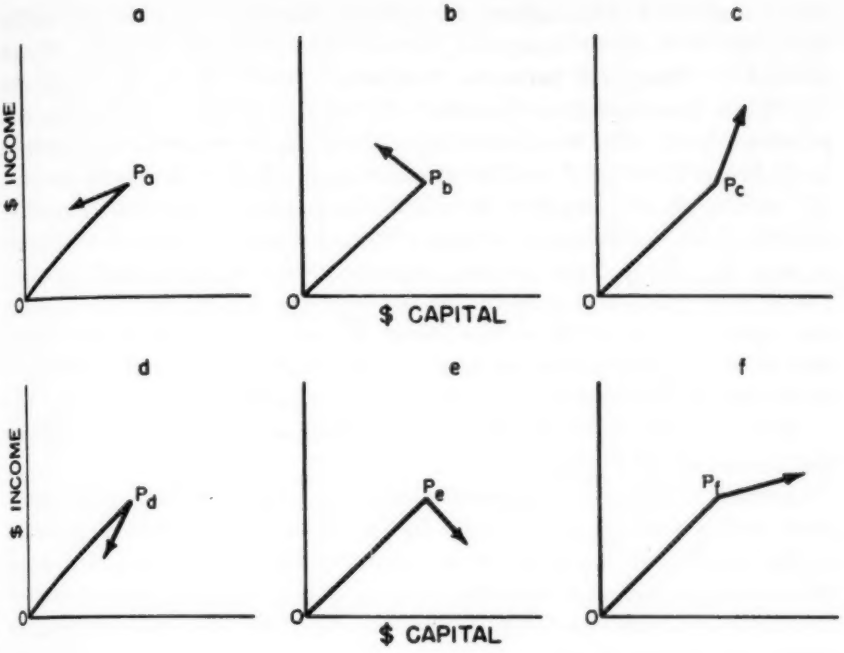


FIG. 3

a movement toward a capital optimum, while an activity fulfilling d, e, or f represents a movement away from the optimum.

A positive capital input-output coefficient means that the activity uses capital. Similarly an activity with a negative capital input-output coefficient increases the supply of capital. A negative z_j-c_j means that the activity increases income while a positive z_j-c_j means it decreases income. The activities depicted in figures 3b, 3c, and 3f have negative z_j-c_j coefficients; figures 3a, 3d and 3e have positive z_j-c_j coefficients. Similarly the capital input-output coefficient for 3a, 3b and 3d are negative while 3c 3e and 3f have positive capital coefficients.

Situation 3b is distinguished from all others because it has negative capital and z_j-c_j coefficients. Situations 3a, 3c, 3d and 3f can only be distinguished by testing their income-capital ratios against the income-capital ratio of the first iteration. A capital optimum program presents no possibility of a movement such as 3a, 3b or 3c. Conversely, a sub-optimum program does present such a possibility.

Definition of Test Ratios

To test the income-capital ratio or capital-income ratio of an activity against the ratio of the present program, a new column, the "ΔP_o col-

umn," is defined. This column records the change in income and capital *since the last capital optimum.* A new decision row, the "f_j" row, is defined to distinguish between situations represented by figures 3a and 3d. When the capital coefficient is negative and the z_j-c_j coefficient is positive, the f_j ratio is calculated by dividing the capital coefficient by z_j-c_j. When the capital coefficient and z_j-c_j coefficients are both positive, the activity is not brought in. When the capital coefficient is positive and the z_j-c_j coefficient is negative (the situation illustrated by figures 3c and 3f), the d_j ratio permits the two situations to be distinguished. The d_j row is calculated as in the first example, i.e., by dividing z_j-c_j by the capital coefficient when the former is negative and the latter is positive. If the capital coefficient and z_j-c_j are both negative, then the z_j-c_j is divided by the capital coefficient and is recorded in the "e_j" row. The e_j ratio provides a criterion for choosing between two activities fulfilling the conditions of Figure 3b.

In short, if the z_j-c_j coefficient is negative, divide by the capital coefficient and put the resulting ratio in the d_j or e_j row according as the capital coefficient is positive or negative. If the z_j-c_j row is positive and the capital coefficient is negative, divide by z_j-c_j and record the result in the f_j row. If both the z_j-c_j, and the capital coefficients are positive, the activity is not brought in.

Reference has been made above to "test" ratios. These are given by the entries in the d_j and f_j row beneath the ΔP_o column. A d_j is calculated for this column, despite "the signs being wrong." Generally, a d_j or f_j more negative than in the "test" (ΔP_o) column means that this activity should be introduced.

Rules

The above discussion may be summarized by the following rules for the calculation of the successive capital optima.

1. Provided there is an f_j more negative than the f_j in the "test" (ΔP_o) column, bring in the most negative f_j.

2. If none of the activities qualify under Rule 1; bring in the largest positive e_j.

3. If none of the activities qualify under Rules 1 or 2; bring in the most negative d_j.[16]

---

[16] Dr. Burton L. French has recently drawn my attention to a program where these rules give some difficulty. If an activity *has* to be introduced at zero level the f_j row indicates that it should be removed. However, the introduction of an activity at zero level is merely a change of basis at the capital optimum (since the amount of capital used and income earned are unaffected) and instead of removing the activity the largest d_j is taken to indicate the next activity to be introduced. *This discussion has suggested that the simplest way to compute the continuous solution is to introduce the*

The condition for a capital optimum program is that none of the activities should qualify under Rules 1 or 2, and the most negative d_j (i.e., the activity introduced by Rule 3) must be less negative than the d_j in the "test" (ΔP_o) column. The optimum program for "unlimited" capital is attained when none of the activities qualify to come in under Rules 1, 2 or 3. The above condition for a capital optimum means there is no possibility of a movement illustrated by figure 3a, 3b or 3c. The introduction of the largest d_j when a capital optimum has been reached corresponds to a movement such as 3f.

Finding the Capital Optimum

Table 3 presents the "continuous" solution of a linear programming problem using each of the rules given above. In section 1, all the capital coefficients are positive and all the z_j-c_j's are negative; hence, only the d ratio is used. Though d_1 and d_3 are more negative than d_2, P_2 is introduced because the other two activities are not feasible (they require corn and manure respectively, which have zero initial supply). In the second section the f ratio has been calculated for P_6 while P_1 and P_3 use the d ratio. As f_6 (−2.00) is no more negative than the figure in the test column (−2.00) the activity is not brought in by Rule 1. Rule 2 is not fulfilled, so the most negative, feasible, d_j is introduced. Since d_1 (−1.00) is the most negative d_j, P_1 is introduced, and since d_1 (−1.000) is more negative than the figure in the test column (−.500), section 2 is not a capital optimum. In section 3 the f ratio has been calculated for P_5 and P_6 and the d ratio for P_3. Since f_6 (−2.00) is more negative than the test ratio (−1.333), activity P_6 is introduced in accordance with Rule 1. In section 4, f_5 does not qualify for introduction under Rule 1, but the entry in the e_j row together with Rule 2 indicates that P_3 is the incoming activity. In section five, P_8 has both positive capital and z_j-c_j coefficients; thus the activity should not be introduced. As f_5 is no more negative than the test ratio, Rule 1 is not fulfilled. However, there is an entry in the d_j row, and P_7 is introduced in accordance with Rule 3. The figure d_7 (−.500) is less negative than the test ratio (−.869), hence section five represents a capital optimum.

It will be recalled that the entries in the ΔP_o column were defined as the change in capital and income *since the last capital optimum.* Since section 5 of Table 3 is a capital optimum, the entries in the ΔP_o column of section 6 record the change in capital and income since section 5. For

---

largest d_j *in all cases, at zero level if necessary.* In the typical example this latter rule leads to P_1 replacing P_7 (since d_1 is −.954 and R_7 is 0), second to P_3 replacing P_8 (d_3 = −.907, $R_8 = 0$, in the second section of this solution) and finally to P_2 replacing P_5 ($d_2 = -.837$, $R_5 = 2$) to give the first capital optimum.

capital we have -140 ($= -430 - (-290)$) and for income 70 ($= 322 - 252$). In section 6, no activities should be brought in under any of the rules; hence, this section represents the optimum program for "unlimited" capital.

Figure 4 illustrates, in terms of capital and income, the successive steps taken in finding the capital optimum. Steps 1 and 2 correspond to the movement illustrated in Figure 3c; steps 3 and 4 correspond to figures 3a and 3b respectively.

A useful check for computation is: The sum of the capital supplies in each of the previous "capital optimum" ΔP_o column multiplied by their respective d_j's should be equal to the income of a "capital optimum" program. Thus for the second capital optimum in Table 4:

$$(-290 \times -0.87) + (-140 \times -0.50) = 322.30$$

Application to Extension

In some of the more ambitious linear programming studies, the presentation of optimum plans for several discrete levels of capital and resource situations has led to such a plethora of results that farmers and even county agents have had difficulty in distinguishing the program that

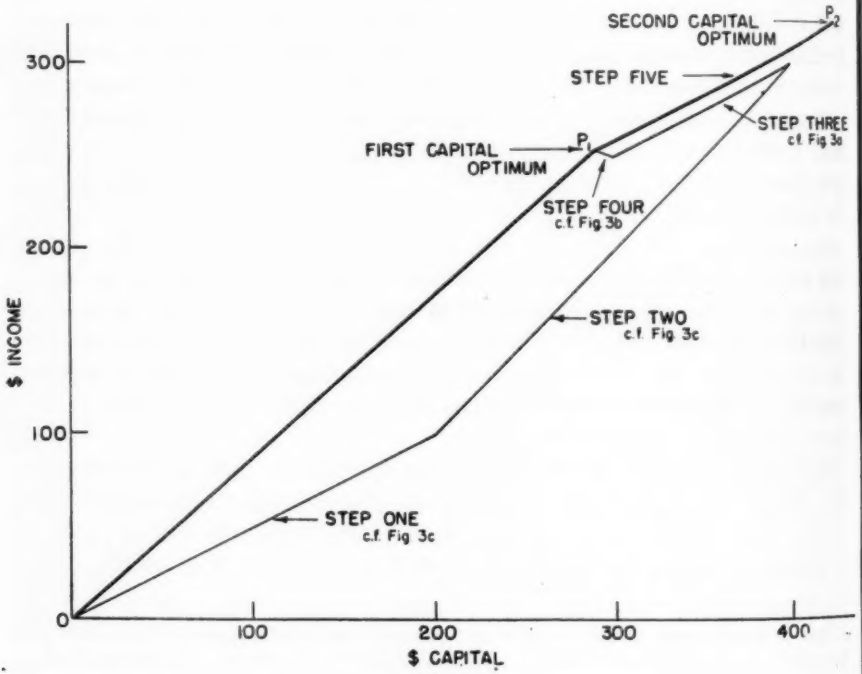


FIG. 4

is applicable to a particular situation and capital level. A graph such as Figure 1 drawn for each situation will reduce this difficulty. Once the farmer has decided which situation applies to him in terms of acreage, building space and labor, he can "read off" his optimum plan. In Figure 1 the process of "reading off" the optimum plan for a farmer with $4,000 of capital has been illustrated.

Figure 1 could be used by extension personnel when they explain to farmers how different amounts of available capital usually lead to different farm plans. A glance at Figure 1 should suffice to dismiss the argument that because a rich "good" farmer produces mostly potatoes and few oats, therefore a less prosperous farmer should also concentrate on potatoes. When the extension division wishes to contrast the positions of farmers with different fixed assets, say with or without a dairy barn, the results of a "continuous" solution for both situations could be included on the same graph.

General Remarks

Although the above discussion assumes that the investigator wishes to discover the effects of varying capital, it is obviously possible to vary any of the other resource restrictions. It is also possible to relax two or more restrictions at the same time. It does not, however, appear profitable to work out the details of such a method until a problem is encountered in which this relaxation is desirable on theoretical grounds.

Problems may also be encountered in which the investigator is interested in the optimum program for a farm when capital varies within given limits. In this case the optimum program for the lower limit can be computed by the conventional simplex method, and the "continuous" solution used over the relevant range.

In Loftsgard's study referred to in footnote 11, it was found that, using desk machines, computations for five discrete levels of capital took approximately three times as long as for the "continuous" solution. Obviously, if this study had included a hundred discrete levels of capital it would have increased the computing time for the "discrete" solutions twentyfold while leaving the time for the continuous solution unaffected (since this solution gives plans for *all* capital levels, from zero capital to unlimited capital).

CLASSIFICATION OF VALUES THAT SERVE AS MOTIVATORS TO CONSUMER PURCHASES*

M. E. JOHN
The Pennsylvania State University

THROUGH social interaction a system of social values develops that serves as criteria against which individuals evaluate all aspects of their environment. Understanding the commonly held values in the American culture and how they operate in decision making helps one to understand consumer behavior.

This paper is an endeavor to classify these values and to indicate how each plays a part in economic decision making. The classification grows out of the findings of several research studies conducted at The Pennsylvania State University. The studies drawn upon in this analysis are as follows:[1]

1. Differential distribution of values for items of household equipment and furnishings.
2. The human factor in farm management.
3. Social and psychological factors associated with level of egg consumption.
4. Factors associated with the level of consumption of floral products.

In none of the above studies was the purpose to develop a classification of values. Therefore, the references used in this paper come from a separate analysis.

The general classification grows out of the first study. The others are used at various points in testing its validity through application to other commodities. These demonstrate that no two commodities satisfy the value system in exactly the same manner, thus no two goods are completely substitutable.

In the first study namely "A study of the relative value placed on various items of household equipment and furnishings," four basic questions were asked to obtain the values that served as criteria in evaluating the utility of an object. They were as follows: (1) "What item of household equipment or furniture were you particularly proud to show your friends when it was new?" (2) "What was there about this item that made you proud of it?" (3) "What item of household equipment or furnishing were you glad you purchased in spite of the fact that you were not particularly proud to show it to your friends?" (4) "What was there about this item

* Journal Series No. 2066 of The Pennsylvania Agricultural Experiment Station.

[1] The project leaders were as follows: (1) Francean L. Nolan and M. E. John; (2) Carroll V. Hess and Leonard Miller; (3) Bruce Bylund and Ralph L. Baker; (4) Clarence E. Trotter.

that made you glad you had it?" From the answers obtained the following classification was developed.

Functional Values

In evaluating each new technological development, one always weighs the contribution it makes in meeting a desired goal. This is frequently done subtly and unconsciously. If the contribution is interpreted as worthy we consider it *practical, functional* or *useful.* Many material developments are associated with fulfilling physiological needs. A list of functions performed could be formulated, for example, to cook, preserve food, transport us, provide comfort in sitting or lying and many other things.

In primitive society the entire emphasis was devoted to providing a means of performing the "essential task." If the primitive stove cooked this was all that was expected. This was the most important thing; very little, if any, attention was given to the quality or nature of performance. For instance, number of homemakers in the study of household equipment and furnishings indicated they were glad they had purchased and were proud to show their friends a new electric stove. In indicating why they felt this way they gave such answers as, "Easy to cook on," "quicker," "more convenient." Those who expressed satisfaction and pride in the purchase of a new electric washing machine gave as reasons, "made washing easier," "does a better job." In no case did respondents report they were glad to have or proud to show an item of household equipment or furnishing because it worked.

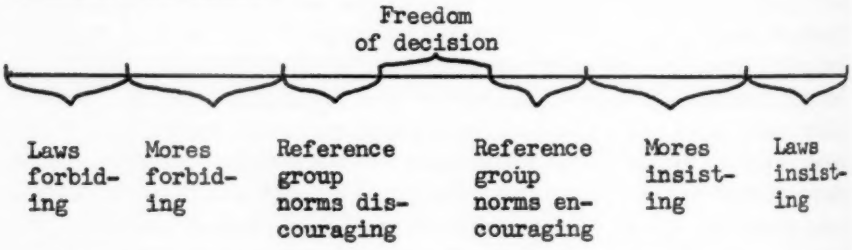
Similarly food is not only judged by its attainability and efficiency in satisfying the appetite. In no case did consumers interviewed in the study of social and psychological facts associated with level of egg consumption give as reasons they ate eggs the fact that they staved off hunger, instead they gave as reasons the "nutritional value," "palatability" and "ease of preparation." Since all stoves cook, washing machines wash, and all foods eliminate hunger, selection today is not based on these characteristics but on the refinements by which they perform their tasks according to socially defined criteria. These desired characteristics have come to be values in themselves within the classification of function.

The American culture has defined a common set of attributes that are used in judging the performance of most functional items. A list of such qualitative factors could be formulated. It would include such criteria as amount of time saved, energy saved, comfort provided, uniformity of performance, and significance of the task performed. Such criteria are

used in selecting a tool by a farmer, a stove by a housewife or an item of office equipment by a business man.

Status-giving Values

The American frontiersman in making his choices gave little attention to the qualitative characteristics of a commodity. One's social position in the group was enhanced by merely having the various coveted items and even more by his physical ability and power to cope with nature and man. As time has gone on, the position of an individual in the social group is dependent less on his physical strength and more on his ability to select and acquire highly-sought-after items having cherished characteristics. People are motivated to seek items that contribute most to their social position. In this attempt we seek things essential to the norms of society and avoid those choices that bring negative responses. Some of these selections society has defined by law. For instance, if you choose to live within a certain residential area building codes may require a house of a certain value. In other situations society brings influences on choice through the mores; namely those common ways of acting and thinking that have been defined as "good" or "bad." Then in addition, individuals have a tendency to accept a more limited frame of reference than society as a whole such as the professional class or the members of the Elk's Club. The nature of the influence of one's social environment on economic behavior can be illustrated in the following diagram. One's reference group in addition to its own social influence has within it the restrictions of law and the mores. The reference group then represents all that is important to the individual as far as societary influence is concerned.



The desire to keep up with the Joneses has long been recognized as a motivating force. But in the past we have not answered the question as to who are the Joneses. Obviously those far below us in the socio-economic scale create no sense of competition. Likewise, those far above us are hopelessly out of our reach. Their expenditures have little influence on ours. The so called Joneses exist for most of us somewhere in between. Within this range just who are the Joneses? In answering this

question the concept of reference group is most helpful.[2] We are motivated to spend our money for those purchases that are cherished by the reference group. The group that one selected as a frame of reference may not be one in which he is a member but may be one he idealizes or is striving to achieve. Many young girls read movie magazines, for instance, taking movie actresses as their models. They compare their body measurements with those presented in the magazine, then go on diets to make their measurements conform. They copy them in hair style and in many other ways. Frequently, we observe an individual whose purchases of goods does not appear logical in light of what on the surface seems to be the reference group. Consequently, we label him as queer or odd. If we had a fuller understanding of his reference group, his behavior might appear more logical.

The importance of one's reference group as a motivating force is reflected in the study of the human factor in farm management. Farmers who used dairymen in their own neighborhood as a basis of judging whether they had high production, high labor efficiency, and the like, were satisfied with a lower level of attainment than farmers who used as their reference group other dairymen with high production scattered over a larger area. The first group used a locality frame of reference, the second used farmers with high-producing dairy herds.

Certain objects essential for measuring up to one's group may have been universally attained by the members and therefore do not serve as motivators. On the other hand, there is always a relatively small group of material items that most members of the group are pushed to obtain. These are what the group considers as "the new." There is a certain amount of substitutability among such items in terms of their contribution to social prestige. For instance, in one reference group the wives are all seeking electric clothes dryers, dish washers, televisions and automobiles in the middle price range. Any woman in the group did not have to have all of them to maintain what she conceives as her social position, but it is important that each have her share. Thus, one may have a dishwasher and television, another a dryer and television, a third a brand new car and television. All three feel, therefore, that they are keeping up with the Joneses.

Any object cherished by the group and possessed by the majority is frantically sought after by the small minority. One feels that his position in his reference group is greatly enhanced if he is successful in attain-

[2] "Contribution to the Theory of Reference Group Behavior," Robert K. Merton and Alice S. Kitt, *Continuities in Social Research: Studies in the Scope and Method of "The American Soldier,"* edited by Robert K. Merton and Paul K. Lagarsfeld, Glencoe, Ill. Free Press, 1950.

ing an object cherished by all but not yet possessed by any member.

In the study of household equipment and furnishings several respondents spoke with pride concerning an item that others did not have. They reflected this by the following types of replies: "No one else in my crowd had one like it." "First one in town to have it." "First one in the community to get one." "First of its kind in the valley."

The harder we have worked to achieve the group norm the greater is the satisfaction gained from attainment. This was revealed by a number of the respondents in indicating reasons for being proud of a new household item. These responses ran as follows: "Worked so hard to get it." "Waited so long to get it." "Had done without it for a long time while most everyone had one."

Values Giving Self-esteem

As a result of the interaction within a group there is a tendency for the values of society, including those of the reference group to become internalized. Thus, a person must seek certain objects not only because of the group's emphasis but also because of importance of the object to the self. If a young lady uses movie actresses as her reference group she tries to copy them even if she is never seen by them. The group's criteria for achievement become the individual's criteria and a self-inflicted motivating force. The internalizing of the values of the group by the individual serves to stabilize one's behavior and to make him internally more consistent.

As time has gone on the behavior of reference groups has become more situational. Thus a member feels that in being "a good fit" he should vary his clothes or his food, with the situation. Narrowing down the social concept of the appropriateness of a certain item is one way we have increased the demand for new items. The individual does not rebel to changes because they become so much a part of him that he feels "they should be." To not fall in line creates a sense of guilt.

The more an item reflects an expression of individual attainment in its achievement the more it contributes to self-esteem. One respondent gave as her reason why she was glad she had purchased a particular household item, "ashamed of myself that I didn't have one before." Several women expressed pride in an item because "they had made it themselves." This is one of the sources of the appeal of "the do it yourself" emphasis that has become prominent in the last few years.

Sentimental Values

Sentimental values arise from three sources: (1) attachment to a loved one; (2) pleasant memories associated with a happy experience or event;

and (3) association with the historical. The potency of the first source is dependent in part upon the sense of responsibility felt by one person to another as defined by the culture. For instance, the mother's attachment to her child is reinforced by society placing the responsibility for the child's care and welfare in the hands of the parents. Therefore, when the seller of a commodity stresses its importance to the health of the child the mother's sentimental attachment, society's expectation, and her self-esteem are all effectively appealed to at once.

Several homemakers reflected great pride in pieces of household equipment because: "My husband made it." "The first thing my husband ever gave me." "Everyone liked it." "It was my mothers."

The importance of a cherished event was reflected by statements like "the first thing we purchased after marriage."

Some avenues for expressing the sentimental become institutionalized and people conform because of social expectancy. A good example is the sending of flowers to funerals. Frequently the expression of sentiment may become routinized even between two individuals. As a result the act may lose much of its sentimental content. To not give the customary flowers in time of a funeral or the usual gift at Mother's Day dramatizes the lack of sentiment more than the giving portrays the existence of sentiment. Merchandizers of commodities associated with the sentimental frequently attempt to institutionalize the use of their commodity in order to create a social commitment that will insure a continuing demand.

In America, restaurants consistently stress old-fashioned dishes and hotels stress their historical heritage. In traveling through Europe one cannot help but notice the pride and satisfaction that comes from the historical. Homemakers visited occasionally reflected pride in an antique item whose utility could be questioned.

Aesthetic Values

As the level of living of people increases values other than the functional become more and more important. This is particularly true of the aesthetic. This value is frequently embodied in the design of functional items. Thus, in the study of values associated with household equipment and furnishings housewives spoke with pride concerning "the smoothness or shinyness of the stove and refrigerator," or "how well they fitted in with the rest of the kitchen." Today one item must blend in with others in the setting in order to produce "the effect." Design and color are becoming more important to the consumer.

Merchandizers of all products are becoming more aware of the importance of making their products appealing to the senses. Odor, tex-

ture, and eye appeal attract individuals in impulse buying. In packaging food or in displaying it we become aware of this appeal. The aesthetic atmosphere of one's environment will affect his attitude and general outlook. One is more likely to be favorable to a place of business and its product if it is psychologically pleasing. There is also a tendency to use the aesthetic as an indicator of quality.

Economic Values

One of the approaches constantly used by the sellers is that of "the good buy." The economist has long emphasized that more of a commodity is sold at lower prices. This is largely a static concept. The dynamic aspect of price may be even more important. For some reason in America we feel a commodity is worth the price if it can be bought cheaper than at the usual price. Many a person has bought an item at a sale not because they had use for it but because it was "so cheap." The concept of a good buy may not depend as much on the present price as upon the relative position of the existing price in relation to the previous or usual price. The trade has certain conceptions about the psychology of pricing. There is a universal feeling among business people that odd-cent pricing of objects in the low-price range will sell more than even-cent pricing. This belief needs to be tested by research. In fact, the whole area of price manipulation as it affects consumer behavior needs through study.

Conclusions

Individuals place varying importance on each category in their own value system. Within each class there are numerous values. For instance, as has been indicated, within the functional category values such as time saving, labor saving and uniformity of performance are included and under the aesthetic abstract concepts concerning desired design, the blending of colors and the appeal of textures.

Values serve as criteria for evaluating a commodity. The attainment of a single item usually meets the criteria of more than one value. Likewise, more than one object is needed to satisfy a single value. The more an individual interprets the attainment of an item as essential to him in meeting one of the above values, the greater is his motivation to seek it. Likewise the more an individual interprets an item as subtracting from achieving the above values the more he avoids it. Many times one individual may seek a commodity while another will shun it. The difference in behavior arises out of difference in definition of the item as contributing or subtracting to the attainment of values. For instance, in a study of consumer concepts of eggs it was found that many would not

eat them because they felt they contributed to gall bladder trouble or some other ailment, while other homemakers insisted that each family member eat at least one egg a day because they were vital to good nutrition. For effective selling or merchandizing of any product it is essential to know the concept of a commodity that contributes to defining it as essential to the six classifications of values and thus to a high level of consumption. It is likewise just as important to know the definition of the commodity that leads to low consumption. The job facing the merchandizer is to eliminate through promotion those conceptions of the commodity that retard consumption and to instill into the thinking of the consumer those ideas that contribute to high consumption. When negative concepts are based on facts it is necessary to change the nature of the commodity in order to have a more favorable basis for the promotional program.

RESEARCH ON ADVERTISING EFFECTIVENESS

CHARLES F. SARLE
National Analysts, Inc.

AGRICULTURAL colleges are now emphasizing research in advertising effectiveness. This trend has come about because the U. S. Department of Agriculture and some agricultural groups are seeing in advertising and promotion a way to increase demand for agricultural products.

National Analysts uses three types of research on advertising effectiveness:

Test Market Areas
Advertising Copy
Consumer Psychological Surveys.

Test Market Areas

Evaluation of an advertising and promotional program for a product or brand in "test market areas," usually metropolitan areas, requires reliable data on sales volume before and after the promotional program. It is rather costly when such data have to be obtained from a probability sample of retailers or consumers. This cost can be justified by broadening research objectives to include, for example, testing the sales effectiveness of innovations in merchandising and pricing at point of sale in retail outlets.[1] Advertising may be used as one of the "treatments." Or, when sales volume data are obtained from a probability sample of households, the study objective can include getting information from consumers to use in maximizing effectiveness of a manufacturer's advertising and promotional efforts—Consumer Psychological Survey Research.

From the standpoint of sound methodology, Test Market Research should include *control* test market areas where the advertising and promotional program is not carried out. Two pairs of such test market areas would be better, two for the promotional program and two as controls. Even so, research results are not always conclusive nor can they be generalized beyond the test areas. A before-and-after measure of sales volume provides no information on the delayed or longer-term effects of the promotional program unless sales volume data are later obtained over a considerable period.

Advertising Copy Research

Advertising Copy Research was developed from Editorial Readership

[1] Max E. Brunk and Walter T. Federer, "Experimental Designs and Probability Sampling in Marketing Research," *Journal of the American Statistical Association*, September, 1953, Vol. 48, pp. 440-452.

Research. Although media research is never intended to be a substitute for editorial judgment, it is helpful to editors and publishers interested in improving the quality and effectiveness of their publications.

Our more than 700 readership studies for consumer, business, industrial and employee publications have given clients valuable information about the following: total potential audience; audience being reached; actual reading audience; reader reaction, both editorial and advertising; and other areas of special interest relating to promotional efforts. It was only a short step from Editorial Readership Research to Advertising Copy Research. Both are frequently combined in one research program.

Advertising evaluation studies provide advertisers with important and useful information about the following:

...How well a particular ad, or type of ad, attracts attention (consumer awareness)

...How accurately and completely the copy message is understood—what meanings are communicated (a matter of ideas and semantics)

...What degree of retention results from exposure to the ad

...What associated opinions the viewer holds about the ad and the product

...The positive or negative impact on the consumer and the subsequent action implied

...Appropriateness of the ad to media used.

These "pull" and "impact" measurements can tell how efficiently particular ads are working. Such research is not restricted to printed material; similar studies are conducted for radio and TV programs. Commercials are subjected to comprehensive investigation. But, whether for visual, audio or combined presentation, the newest techniques provide the information needed to evaluate advertising. The respondents for editorial readership and ad copy studies are selected on a probability sample or, in some cases, an experimental design basis. Ad copy may be either pre- or post-tested.

Consumer Psychological Survey Research

Consumer Psychological Survey Research is an effective integration of what is loosely called "motivation" research and consumer survey research based on a probability sample. The results of consumer psychological-sociological research obtained by interviewing small diverse samples of respondents are tested in terms of a much larger representative (probability) national sample. The sample is large enough to show how the study results *differ* among various groups of consumers. Consumers are grouped by socio-economic status; urban, suburban and rural; size and composition of family; and other personal or household characteristics.

The main purpose of Consumer Psychological Survey Research is to get information to maximize the sales effectiveness of a manufacturer's advertising and promotional efforts. Results of this research have other important uses in a company's operations, however, such as increasing the efficiency and effectiveness of sales training and merchandising; pointing out needed changes in packaging and product design. The research goes beyond "traditional" marketing survey research, which gets information on consumers' characteristics, behavior, choices, uses of the product, *stated* attitudes and opinions. The objectives extend to the important area of finding out *why* respondents behave and react as they do, their perceptions, needs, motivations, anxieties and other mental and emotional processes.

For example, this research discovers how various groups of consumers *see* or perceive a product, brand, make or model. Consumers are motivated and behave in terms of their perceptions of the product and the manufacturer. New understanding of perception has enormous implications for advertising, promotion and sales effort.

The perception aspects of this research provide an advertiser with reliable knowledge about the following:

- ...The features of his product (and directly competing products) that are *seen as important* to various groups of consumers who comprise the actual and potential market
- ...The *good* features they do *not* see in the product
- ...The features they see, correctly or incorrectly, as *poor* or unsatisfactory
- ...How much influence each of these features has in the final decision to buy (the "cues" followed in selecting a product or brand).

This knowledge helps the advertiser to pinpoint his sales message toward those features of his product consumers see as most important to them, and toward overcoming their impressions of the features they incorrectly see as unsatisfactory. The advertiser can also modify those features of the product that consumers *correctly* see as unsatisfactory–that is, improve quality, design, packaging, etc.

This research is designed to find out how product or brand loyalty can be increased; how loyalty for a directly competing product or brand can be weakened; how uses of the product can be increased; the influence of dealers and of various members of the household in the buying decision; who in the family has the most influence; features of the product that are most important to the influential members; where the influential members get information about the product; and their confidence in the sources of information.

This knowledge helps the advertiser to direct his advertising, promotion and sales message toward men, women or children, depending on

who in the family is most influential in the buying decision—and in terms of the particular features most important to them. It also enables the advertiser to select the most effective advertising themes and appeals, media and other channels of communication with his consumers and potential consumers. The advertiser can see where his communication with prospective buyers can be most profitably strengthened or amplified—that is, where his advertising dollars will do the most good. He will learn what combination of influences adds up to the purchase of his product as opposed to directly competing products—and how this situation can be fortified in the future. He also learns what causes rejection of his product and what to do about it.

The results of this research provide the advertiser with a sound scientific basis for planning and directing his advertising and promotional efforts. The researcher and the advertiser, however, must be aware of the pitfalls in Consumer Psychological Survey Research and take precautions to avoid them.

Pitfalls in Consumer Psychological Survey Research

The pitfalls common to all consumer research are *intensified* in Consumer Psychological Survey Research. Even with sound probability sampling procedures and a competent experienced national interviewing staff, the more serious dangers, difficulties or errors into which the researcher and the client may fall are:

1. *Theoretical constructs limited to one or two social disciplines, such as economics and statistics.* Failing to use present knowledge of dynamics of human behavior and to draw on a comprehensive theoretical background leads to inadequate delineation of the study problem. *Areas of interest* that tap *key* factors underlying a complex of interrelated problems are not sharply delineated. The failure to use present knowledge of the social sciences also leads to inadequate development and uncritical screening of study hypotheses, and invalid analysis and interpretation of study findings.
2. *Ineffectual interviewing procedures:* The use of direct questions that may get only superficial or socially acceptable answers rather than the respondent's real convictions and feelings; use of techniques too abstract or complex to bring successful responses from all people interviewed in a national survey.
3. *Communication breakdown between the researcher and the client:* This breakdown is likely to occur in problem setting, conceptualization and reporting study results. The remedy involves a dual responsibility of the researcher and the client. The researcher should make every effort to avoid semantic misunderstandings. He should

clearly define and explain unusual but necessary terms and concepts. It is the client's responsibility to try to understand, not to reject on the basis of strangeness. The study report should be read critically by a nontechnical person and revised as necessary before presentation to the client. Failure in these regards can lead to rejection of basically good research and reluctance of business to use valuable tools and theories.

4. *Breakdown in drawing conclusions from study data.* Conclusions may be irrelevant or unusable because they lack clarity or are too broad or narrow in terms of the problem. The most common cause is inadequate problem formulation. Unfortunately, haste in the analysis and interpretative stage is almost as common a cause, usually stemming from client pressure for study results. Clients can usually understand the time allotments for field interviewing, editing, coding, and tabulating, but too often they fail to appreciate the need for adequate time for analysis and interpretation.
5. *Client's inadequate understanding of the value of study results.* This is due to unrealistic assessment of the place of research in problem solving. Consumer Psychological Survey Research can provide only a part of the information required for most business decisions. An important responsibility of the researcher is neither to overstate nor understate the reliability and usefulness of study findings.

The nature of these pitfalls indicates the necessity for interdisciplinary research planning, direction and supervision by a study team of trained social scientists—economists, psychologists, sociologists and statisticians. All must have practical experience in socio-economic survey research. This well balanced team must work together closely and systematically throughout the entire study.

For each of our studies an appropriate team is selected from among our staff of social scientists. The study director has over-all responsibility for all phases of a study and for keeping the client's market research director informed on study progress. Whenever possible the decision-making executives who expect to use the research results are included in early problem formulation discussions and at the presentation of study findings.

The team does consumer psychological and other socio-economic survey research in two major phases: 1) the developmental research phase, and 2) the field survey research phase of interviewing, coding, tabulating, analysis and interpretation.

The developmental research phase carries the investigation through structuring the final field questionnaire and preparing interviewer instructions. It includes:

1. *Careful delineation of the problem.* This most important of all steps usually calls for several conferences with the client. A clear statement of the problem and of the areas of interest for investigation are essential to hypothesis development, procedure evaluation, sampling decisions and data interpretation.
2. *Review of previous research.* This is valuable for picking up useful theoretical and methodological leads and avoiding blind alleys. Often the client is helpful, because he is usually well informed on relevant research, both published and unpublished.
3. *Intensive investigation of the problem.* This involves first the development of study hypotheses. These in turn are evaluated and screened by several waves of interviewing of small diverse samples by especially trained interviewers. New pertinent hypotheses are usually discovered in evaluating these interviews. The aim is to explore in detail the strength, pattern, availability to recall, verbalization, etc., of the underlying perceptual, motivational and other psychological factors involved in the type of consumer behavior being studied. Most useful here are skilled intensive interviewing, projective techniques, critical incident technique, group interviewing and small-scale experiments. Scaling and other devices to get measures of intensity or amount are often used.
4. *Development of field interviewing procedures.* When enough is learned about a problem area, it is usually possible to select, adapt or develop interviewing techniques that yield quickly from a large probability sample the very data so painstakingly secured in step 3. These procedures are carefully tested before finally structuring the field questionnaire and preparing interviewer instructions.

Steps 1 through 4 aim to discover the most pertinent areas of interest for investigation, factors involved, and how to find out about them most efficiently and completely. Steps 3 and 4 are not followed mechanically. How far either of them is used depends on the nature of the problem and the clients' needs. Because client problems and needs vary, developmental research methods used in moving from problem to field questionnaire design must also vary.

The field survey research phase includes training and supervising interviewers, checking, coding, tabulating, analyzing and interpreting study data—all under the direction of the study team. The analytical tables are reviewed, evaluated and interpreted by the team. The aim of this phase is to discover how consumer needs, motivations, perceptions, anxieties and other cognitive processes concerning the product, brand and manufacturer are distributed and patterned in the consumer population. By using the final field procedure to get data from a probability

sample of the population, we can determine what kinds of people exhibit what kinds of motivations and other cognitive patterns in their buying decisions and behavior, and the proportion of each in the total population.

Conclusion: Each of the three types of research on advertising effectiveness are useful, especially in combination. For an established product, Consumer Psychological Survey Research provides a scientific basis for planning future promotional effort and for selecting effective themes and appeals. Advertising Copy Research tells how effectively these themes are presented in the ads. For a *new* product Consumer Psychological Research at the close of a test market area program provides the advertiser with valuable leads for national promotional effort of the new product.

QUESTIONS FOR DESIGNERS OF FUTURE WATER POLICY*

EDWARD A. ACKERMAN
Resources for the Future, Inc.

AMONG all of the past documents treating national water policy one will look in vain for a definition of the word "policy." He must turn to Webster who gives three alternative definitions of policy: "prudence or wisdom in the management of affairs"; "management or procedure based primarily on material interest rather than higher principles"; and "a settled course adopted and followed by a government, institution, body or individual." These definitions themselves illustrate why Americans have difficulty in understanding each other when they consider policy recommendations of an economic nature. Any one of the three might very well be applied as a definition of water policy in the United States, although each would be the point of view of a different group. For some the important thing is a settled course, to which reasonable adjustments can be made; to others immediate material interest is the first consideration; and to still others wise management in the public interest is the only management.

A discussion of water policy can start with an element of each. We might consider water policy to be a clear, accepted, reasonably stable body of principles which could be used for the guidance of United States water resources development in the public interest.

Present Policy

How near are we to such an objective at the present time? Or how near have we been in the recent past? I shall offer only indirect evidence in the interest of brevity. Since 1947 two legislatively inspired general commissions (the two Hoover commissions) have examined the problem, and three presidentially appointed bodies covered similar ground (the Cooke Commission, the Missouri Basin Survey Commission, and the recent President's Advisory Committee on Water Policy). They have been supplemented by several groups closer to the daily operations of the government, like the 1951 Bureau of the Budget Committee, the Interagency Committee on Water Resources, and others.

So much general review of water development policy can only mean that we have not had and do not have a clear, accepted, reasonably stable body of principles for the guidance of water resource development

* This article follows substantially discussions presented before the Production Economics Research Branch, Agricultural Research Service, United States Department of Agriculture, March 23, 1956, and before the Kansas Basin Project Seminar, University of Kansas, May 31, 1956, by Edward A. Ackerman, Director, Water Resources Program, Resources for the Future, Inc.

in the public interest. This lack, moreover, has been felt at a very high level in our federal government during two administrations, one Republican and the other Democratic. It has been felt in both the congressional and the executive branches. It also is common knowledge that the individual states have their own uncertainties, encouragements to indecision and frustration, and other difficulties. Not a few states have water development policy problems. Some states have had committees or commissions under their auspices to treat resource development problems. They add further evidence as to the need for policy clarification.

Past Policy Formation

Most observers are inclined to assign the responsibility for this continued obscurity of policy to the activity of special-interest groups. These groups may have contradictory points of view, or contradictory objectives. One cannot look over the record without discerning the importance of these influences in what the nation recently has done to develop its water resources and how it has done it. There are public power and private power groups, western reclamation and flood control interests, partisans of navigation, fish and wildlife, soil conservation, higher farm income, and others. As is well known, each of them has been or is listened to, and each has its wish crystallized in some law or authorization. Each is represented by some agency in the federal executive branch, and by varying numbers of congressmen, who reflect dominant local interests.

These facts of national life have been mirrored faithfully in the attempts made to arrive at a clearer national water policy in the past. They have been largely attempts at coordination, that is, arriving at a summary additive program of development acceptable to all. Since at times this is obviously impossible, there have been added attempts to resolve conflicting forces at the points nearest decisive action—at the cabinet level, in the United States Bureau of the Budget, or in congressional committees. The presidential and legislatively inspired commissions have all been part of this process. Their existence indicated some lack of hope for successful coordination and resolution through the existing channels of the federal government.

Perhaps this is the way it will continue to be, and the way it should be under our form of government. No one can deny that we have made physical progress in our policy obscurity, even if that progress has been at a price. One certainly would not wish to deny the special interest groups their day in court. The course of resource development is likely to be affected indefinitely by the pressure and contention of special interest groups. We cannot hope to eliminate them, and in any event, to do so may not be in the nation's best interest.

This is the first important point about clarification and formation of a helpful national water policy. We must appraise the environment within which policy is to be applied. We reasonably may expect it to be an environment in which the coordination of diverging interests, and the resolution of conflicting pressures will be necessary.

But there is much more to the story. Policy formation that begins with the objectives of coordination and resolution attacks only the superficialities. We may have done too much of this in the recent past. Along with it we need to determine what the important underlying forces are that help to shape our water resource development. Does our present policy emphasize the underlying forces of the past, now weak or dead? How well does it recognize the growing forces that may dominate the future?

I believe that we are inclined to assume in our water policy design that the underlying forces are largely political. The immediate forces certainly are political, and they are seconded by regional or local economic needs or ambitions. But what fundamentals stand behind these forces, which political expressions may reflect or promote on one hand, and ignore, conceal, or resist, on the other? The process of reflecting or promoting, concealing or resisting the underlying forces may be unconscious as well as conscious.

Basic Forces to be Considered—The Geographical Environment

Two examples of important underlying forces are suggested here: the geographical environment, and technology. Proper recognition of them may assist in water policy formation.

The first of these is geographical, and it has two aspects. The most important determinant of economic need for water development is the physical environment within which men live. Men need water everywhere they live, and in no two localities is water naturally supplied exactly in the same manner as to quality, amount, timing, and mode of occurrence. There is no more significant basis for wise development and management of water resources than knowledge of the physical environment. How well do we understand that environment? Does contemplated policy promote understanding of it?

The old discussion and debate over basic data is here recognizable. Some of the following comment on this point has been implicit in all of the basic data discussion of the past. But there is little, if any, mention in all the records of discussion about basic data in the light it should be considered—as the description of an important underlying force for water development.

In past treatment of this subject on a national basis we seem to alter-

nate between two views. One maintains that we have proceeded in our development without adequate basic data, and we need a much greater, more massive attack on basic data problems. Opposed to this has been the view of those who have been interested primarily in construction now; they maintain that there never is enough basic data, that the nation must go ahead with development, and worry about basic data later. The United States Congress has never seen the basic data problem in terms that encouraged appropriation of funds enough to undertake a really massive attack on basic data compilation. This has been true particularly as far as interpretative processing of such data are concerned. And congressional appropriations have been the principal support for such compilation.

I believe that we must despair of ever achieving adequate basic data collection by massive attack on the problem, aimed at blanketing the country with observations minute enough to be meaningful to every significant locality. In part this is because our needs for more detailed data seem to increase as the years go on. The task of obtaining accurate detailed information on micro-climates, for instance, begins to look impossibly large. Add to this the need for detailed information on stream behavior, ground water movement and soil characteristics, and we may look forward to perpetuation of the past complaint about inadequacy of basic data. I consider this likely even if we assume approval of reasonably liberal future financial support by the United States Congress, the state legislatures, and private organizations for basic data compilation.

Does this mean that our policy must adopt the view that has prevailed in the past? This is the view that further development should go ahead disregarding questions of adequate compilation of physical data. I do not believe that we need to adopt this as policy. If one were to say that there is room for a decidedly more imaginative approach to the problem it is not necessarily a criticism of those who have struggled with it in the past. For instance, there would seem to be some doubt that we need to collect and analyze detailed meteorological and hydrological data in all localities in the country to have proper appreciation of flood probabilities. At the same time we should not have to determine our flood control policy on the basis of the last memorable flood, which we have been inclined to do. We now have refined statistical techniques, new electronic aids to computing, and an appreciation of new analytical possibilities on the part of many scientists. With their aid we should be able to obtain a much more selective, and effective, understanding of the qualities of the physical environment as an underlying force in development. But it is vital that this be built into our water policy for some years in the future: the problem of basic physical data is probably not one for massive,

frontal assault, but for selective, highly imaginative treatment. Experiment with ideas for bringing our capacity to collect and interpret data into balance with expanding needs is very much in order.

The second aspect of the underlying geographical force that always asserts itself in development is the physico-cultural entity we have named a region. This is especially important because water exhibits regional patterns of occurrence to a high degree. Furthermore, full development of water resources must be organized on a regional basis at some point in procedure.

The difficulty here is that development must contend with *different types* of region that almost always do *not* coincide. We have thought of water development primarily in terms of river basins. A river basin may be as good a focal area as any to work with. However, the river basin is essentially a surface-water or run-off region. Other important physical aspects of water development have differing regions, like ground water regions, precipitation regions, or water balance regions. Even worse, development efforts must consider economic or administrative regions, because development is essentially an economic activity. Perhaps the most discontinuous with the basic physical regions are the political administrative regions, or the states. How many difficulties we have compounded for water development in the way state boundaries were drawn! Finally there are the economic regions, which we are beginning to recognize more and more as "nodal" regions oriented to metropolitan centers. They also do not correspond to the physical regions which are the obvious engineers' beginning to water development.

This question summarized is: In water development how do we reconcile the different economic and physical forces that stem from the different types of region—forces that are related but do not coincide geographically? Already we have been faced with serious, continuing problems because these underlying forces assert themselves whether we will it or not. We face such problems on the Colorado and on other streams where we have come to an interstate compact division of water. We face them on the Columbia, which we have planned for mainly as an American stream. We face them on the Missouri, where we find that planning for the tributaries is not always the same as planning for the main stem. We are going to face them very seriously east of the Mississippi as the competition for water becomes more intense there.

We shall not solve these problems by allowing for the compilation of "economic and social data" as part of a basic data outline, treating any physical region that is convenient for drafting engineering plans. Here again it may be necessary to alter our concept of what we are looking for. The designer of water policy may well consider allowance for selec-

tive treatment of strategic regional forces in his basic data collection and analysis. If we can arrive at an understanding of the geographical extent of these regions, their dynamic aspects, and the relations among regions we shall add a sound cornerstone for further programs.

Basic Forces—Technology

Technology is the second of the underlying forces that deserves mention as an example. We all know that technologic advance has affected the course of water development, and is likely to affect it even more in the future. Yet we seem to take it more or less as it comes, not trying to assess its impact on our national plans for water development, or upon our administrative organization for these purposes. Sometimes it even seems that we are fighting technology as a force in the way we do things.

An illustration may help to bring out this view of our procedure. The past thirty years of water resource exploitation have been dominated by one characteristic, the rise of multiple-purpose, integrated river basin development. The engineering of multiple-purpose construction and unified water control management on a river are part of the improved technology. They in turn have rested on other aspects of technology, like the development of long distance transmission of electricity, improved metallurgy and turbine design, and the improvement of cement and concrete. Yet for much of that thirty years the nation has refused to acknowledge that it was confronted with a fundamental technologic change that could not be ignored or turned aside. If we were to choose the most striking technical improvements in the art of water development of all time, the combination of techniques that led to multiple purpose integrated river basin management is certainly one. The other two worth mention in the same way were the evolution thousands of years ago of large scale irrigation in Egypt and Mesopotamia, and the design of large scale drainage in the Netherlands commencing about the sixteenth century.

How far did we go toward making this striking technical change meaningful in our water development policy? Slowly we have fitted multiple purpose development into our programs, often under the pressure of circumstance. Unified water control has not fared so well. The way in which we have made this adjustment is significant. Even yet, I believe that we have not stopped to assess the fundamental nature of integrated multiple purpose development, and what it inevitably means in terms of planning, administrative organization and management. For instance, is this now entrenched technique one that naturally favors centralization in initiative, planning, development, and management? Or does it favor decentralization?

Before the fundamentals of multiple-purpose design evolved, our water

development proceeded as single-purpose programs—navigation, drainage, irrigation, some flood control. Our adjustment to the new technology has consisted mainly of continuing each of the old single-purpose programs, expanding and centralizing them to a high degree in the federal government. Slowly we have added to them or adjusted them to multiple-purpose management and operation. The United States Army Corps of Engineers, for instance, is still changing in this respect. Their recent much heightened attention to domestic and industrial water supply as a purpose of development is evidence of this.

The lack of any fundamental analysis of the relation of technologic change to organization is best illustrated in our policy toward centralization and decentralization. For some purposes, like navigation, flood control, watershed treatment, and irrigation our policy has been one of a high degree of centralization in our development. At the same time our national policy for electric power and water supply development, and pollution control has mainly favored decentralization. We also have been forced to experiment with a variety of devices, like the interagency river basin committees, to offset the cumbersome nature of centralized administration in the practical aspects of water development. Whatever the merits of interagency committees or other phases of national water policy, I believe that an outsider fairly might interpret this part of our policy as confused.

The important policy question that has lain before us unanswered in this connection is: In what ways do the technologic changes in water development encourage centralized or decentralized initiative, planning, development and management? They may very well balance on the side of decentralization. But even if that is not correct, it seems unlikely that technologic changes mean at one time both centralization and decentralization. This is a question for the policy designer to work upon.

Technology and Future Policy

Technology may assume even greater importance as an underlying force in future policy determination. We already sense impending problems of large scope because of changes in irrigation equipment design. Applied meteorology and climatology, together with improved ground water exploitation, can make water development of the future three dimensional. Unprecedented waste-disposal problems are arising as new technology is applied in industry. Furthermore, we may possibly see a change in the place of hydro-electric generation as a purpose of water development because of new energy sources. Each of these has profound policy implications. In fact their combined effects can be so revolutionary that we should be prepared to think of water development

entering a new and still different stage from that of the past multiple-purpose period. Because it is likely to be a fast-moving period, it is important that our water policy not be based on the technology of the past, even if it is the immediate past. For instance, what are likely to be the effects of technologic changes in the offing on the size and type of region we have used as a unit for water development?

Population, National Defense, and Water Development Policy

Two of the underlying forces that help to shape development have been mentioned. One was the geographical environment in which development must take place; the other was technology, which shapes the tools used for development, and influences the demand for water. We should also consider, even if briefly, the demographic (or population) attributes of the country. Where and how the people of the country live, and what their movements amount to certainly are basic underlying forces for any development. Important questions which face us here are: What account must be taken in policy of the increasing urbanization of the country? What are the determinants of migration? How is migration likely to be influenced by security needs for dispersal and decentralization? How should policy be adjusted to the likely increasing leisure time of the average American worker? Are other long-term changes in social habits of any significance to future development?

These are difficult questions to consider, but there are others perhaps even more difficult. It was suggested above that we might be interested in the evolution of a clear, accepted, reasonably stable body of principles that could be used for the guidance of water resource development in the public interest. What is the public interest? One example may illustrate the importance of an answer to this question. The federal government has at present very nearly a bipartisan policy that has moved rapidly in the direction of overwhelming dominance of centralized federal spending and management for water resource development programs. The trend not only has been toward centralization, but toward a separation of the responsibility for payment and the enjoyment of benefits. No judgment on the desirability of this from the point of view of our present economy or moral structure is here implied. But we can raise this question both as it concerns efficiency and security: Is increasing centralization of planning, development, and management compatible with the long-range security interest of the nation? We are diverting local initiative into petitioning for federal funds and federal programs. Does this promote the healthy and resilient regional economic structure which may be very valuable in wartime crisis? Even during the last war the decentralization of many governmental economic activities into regional units was

mandatory for nations like Britain, which were part of the war theatre. In a future crisis, should there be one, we may think of our own position as paralleling that of World War II Britain. This is no theoretical question, but one with grave implications for the future of the nation.

Summary: The Difference Between Policy and Procedure

Reduced to its simplest definition, policy is just a way of looking at activity. I have assumed, arbitrarily, that our attention here should center on a way of viewing activity that is in the general public interest. We might describe the general objective of water policy as an effective manner of making water development contribute to the health and strength of the nation. To work toward this objective it is important to understand the difference between policy and procedure. We need policy to determine procedure, but the two are not synonymous. A major part of the recommendations set forward in the past as policy recommendations really have been procedural recommendations. In this group I should place evaluation, project review, program planning, basic data *collection,* water use priority, reimbursement or cost sharing, and others of the list which is familiar. The domain of procedure is the coordination of divergent special interests, and the resolution of conflicts among them. On the other hand, policy should be concerned with the broader considerations that lie behind procedure. The domain of policy is the appraisal of basic underlying physical and social forces that shape the course of development. Policy should provide general guide lines that interpret these forces. Such interpretation will reveal strategic research areas, the place for stable and for experimental administrative organization, the course for federal-state-community relations, the economic range of desirable national investment, security considerations in development, allowance for adjustment to obsolescence, and other items. If policy is so conceived, we may find procedure less controversial and more easily adjusted.

I am convinced that this broader view is essential. We are entering a period in our national history that has the following prospect: (1) A fast growing population that has unprecedented mobility, concentrating in cities at a rapid rate; (2) a fast moving technology that can change quickly and radically means of water supply, and the demands for use or control; (3) inadequate knowledge of the geographical environment, but rapidly increasing need for detailed understanding of it; (4) organization for water development that has not yet adjusted to technologic changes of the immediate past; and (5) uncertain international relations, in which a serious unfavorable turn could alter overnight the problems and operation of our economy.

In this situation, it is vital that professional people place the significant data, and all the important questions about the use of resources before our policy makers in Congress, in the state capitals and elsewhere. We should not fear conscious change, for the greatest security may lie in a policy that allows flexibility and opportunity for experiment. The federal government agencies bear a heavy responsibility in this, for they will continue to dominate the water development programs of the nation. However, the professional people who devote their efforts to regional work also can have important influences on national policy. To do this they must keep in mind the basic forces that underly policy evolution. They can afford to ignore the surface controversies of the day, if they bring understanding of long-run realities to their region and to the nation.

UNIVERSITY OF MICHIGAN LIBRARIES

SHORT CUTS IN PROGRAMMING COMPUTATIONS*

JAMES N. BOLES**
University of California

THE computing time to derive an optimum program of activities using the method of Charnes, Cooper, and Henderson[1] depends upon the number of equations and unknowns and the number of successive iterations required. Particularly if a desk calculator is used and if the number of equations is large, it is important to condense the problem as much as possible and to avoid more iterations than are necessary. A method of condensation is presented that achieves maximum condensation. No computational technique has yet been developed that will insure the minimum number of iterations for every conceivable application. A modified criterion is suggested below for selecting productive processes to incorporate into a production program. This modification is believed to result, on the average, in fewer iterations.[2]

In one of the earliest applications of linear programming to an agricultural economic problem, Waugh proposed a method of standardization of the raw data to assist the analyst in selecting, by graphic procedures, the best single process and the best pair of processes.[3] It was further used to select, partly on intuitive grounds, combinations of three or more processes for nongraphic treatment.

Waugh and Burrows have further developed these ideas in a recent article.[4] An additional objective of this paper is to demonstrate comparable advantages of standarization when the nongraphic method is employed throughout the analysis.

At the risk of presenting shopworn material, the same problem solved by Waugh and Burrows will be used for illustration. It is a typical farm management problem originally formulated by King and Freund.[5] The basic data are listed in Table 1.

---

* Giannini Foundation Paper No. 153.

** The author is once again grateful for the encouragement, careful review and helpful suggestions of Dr. Frederick V. Waugh.

[1] A. Charnes, W. W. Cooper, and A. Henderson, *An Introduction to Linear Programming*, John Wiley and Sons, Inc., New York, 1953. For a less technical presentation of the method applied to farm management analysis, see James N. Boles, "Linear Programming and Farm Management Analysis," *Journal of Farm Economics*, XXXVII: 1, February, 1955. There are two typographical errors in this article. The right-hand column of Table 4 should read ⅛, 0, ⅜ instead of ⅛, 1, ⅜. In the second paragraph of the Epilogue, the word "statistics" should be replaced by "statics."

[2] In a recent application, the number of iterations was reduced from eight to four.

[3] Frederick V. Waugh, "The Minimum-Cost Dairy Feed," *Journal of Farm Economics*, XXXIII: 3, August, 1951.

[4] Frederick V. Waugh, and Glen L. Burrows, "A Short Cut to Linear Programming," *Econometrica*, vol. 23, no. 1, January, 1955.

[5] R. A. King, and R. J. Freund, "A Procedure for Solving a Linear Programming Problem," Journal Paper No. 563, North Carolina Agricultural Experiment Station,

TABLE 1

Resource	Unit	Process						Resources available
		Potatoes	Corn	Soybeans	Beef	Fall cabbage	Fall lettuce	
		p_1	p_2	p_3	p_4	p_5	p_6	
Spring land	Acres	1	1	1	2	0	0	60
Fall land	Acres	0	1	1	2	1	1	60
Production capital	Dollars	99.40	87.75	19.75	54.40	74.75	53.00	2,000
January-February labor	Hours	2.400	1.540	0	0	0	0	351
March-April labor	Hours	2.000	1.960	0	0	0	0	448
May-June labor	Hours	1.800	3.300	5.330	0	0	0	479
July-August labor	Hours	0	0	2.070	0	8.700	0	388
September-October labor	Hours	0	0	0.436	0	19.100	12.363	424
November-December labor	Hours	0	3.000	0.364	0	9.100	26.737	359
Net cash return		83.40	72.35	27.30	72.05	207.25	455.00	

Rather than use the processes as defined in Table 1, however, each process is standardized to yield the same net cash return, say \$100, and the input coefficients are transformed into percentages.[6] For example, p_3 is first altered by dividing each input coefficient by 27.30, the net cash return per unit, and then multiplying by 100.

p_3 becomes:

3.6630
3.6630
72.3443
0
0
19.5238
7.5824
1.5971
1.3333

. Next

each coefficient is expressed as a percentage of the available corresponding resource. For example, 3.6630 acres of land is 6.1050 per cent of the available quantity; \$72.3443 of production capital is 3.6172 per cent of the available quantity.[7] p_3 is finally defined as follows:

July, 1953, and R. A. King, "Some Applications of Activity Analysis in Agricultural Economics," *Journal of Farm Economics*, XXXV: 5, December, 1953.

[6] Some applications of linear programming include "producing activities" with negative "values" and "selling activities" with positive "values." *Cf.* G. A. Peterson, "Selection of Maximum Profit Combinations of Livestock Enterprises and Crop Rotations," *Journal of Farm Economics*, XXXVII: 3, August, 1955. In order to employ the method of standardization described above, producing and selling activities must be combined into joint activities with positive "values." This may require the definition of a larger number of activities.

[7] Both operations can be performed at once by first dividing each coefficient of a production process by the product of the corresponding resource quantity and net cash return and then multiplying by 10,000. The choice of units of measurement of net cash return and resources is arbitrary. Either or both can be modified to obtain entries in the body of the table which are computationally convenient.

UNIVERSITY OF MICHIGAN LIBRARIES

$$p_3 = \begin{vmatrix} 6.1050 \\ 6.1050 \\ 3.6172 \\ 0 \\ 0 \\ 4.0760 \\ 1.9542 \\ 0.3767 \\ 0.3714 \end{vmatrix}$$

The complete set of transformed processes is listed in Table 2.

TABLE 2

Resources	Processes					
	1	2	3	4	5	6
1	1.9984	2.3036	6.1050	4.6264	—	—
2	0	2.3036	6.1050	4.6264	0.8042	0.3633
3	5.9592	2.6088	3.6172	3.7752	1.8034	0.5824
4	0.8199	0.6064	0	0	0	0
5	0.5352	0.6047	0	0	0	0
6	0.4506	0.9522	4.0760	0	0	0
7	0	0	1.9542	0	1.0819	0
8	0	0	0.3767	0	2.1736	0.6408
9	0	1.1550	0.3714	0	1.2231	1.6368

The first step is to see if it is really necessary to consider the utilization of all the resources listed. The concept is most clearly illustrated for a simpler problem. Suppose that the only processes available are potatoes and corn, p_1 and p_2. Construct a graph with the vertical axis measuring the number of units of the potato process and the horizontal axis measuring the number of units of the corn process. Then consider in turn each resource to be the only limiting resource and draw the locus of alternative process combinations which completely utilize the particular resource. It is clear from Figure 1 that the only effective bottleneck resource in this case is production capital. All other resources are in surplus supply relative to production capital and do not affect the choice of the optimum program. With only a single effective bottleneck, production capital, the optimum program is found by selecting the process which yields the largest net cash return per unit of production capital and expanding it until the limiting resource is fully utilized. In this simple case, corn requires a smaller percentage of the working capital, 2.6088 per cent, to produce $100 of net cash return, so the optimum program is 33.88 units[8] of corn to yield a total net cash return of $3,388.

[8] $\frac{100}{2.6088} = 33.88$

We now need to develop a criterion which will identify, for problems which involve more than two processes, those resources which are at least potentially limiting and those which remain in surplus supply for all feasible programs.

Here, too, we can appeal first to our simple example. Suppose we had not been so thorough and had only clearly defined the locus of combina-

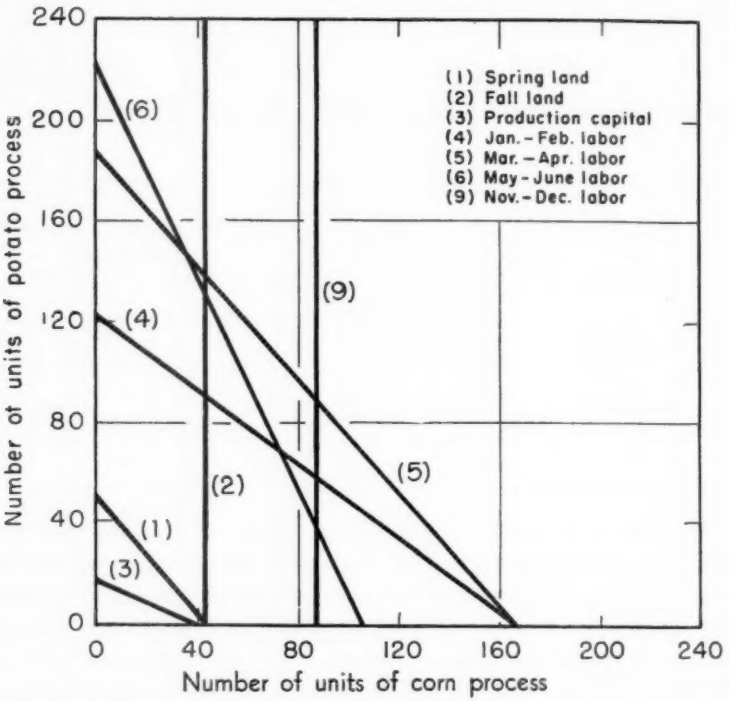


FIG. 1. ALTERNATIVE FEASIBLE COMBINATIONS OF THE POTATO AND CORN PROCESSES CONSIDERING EACH RESOURCE IN TURN AS THE ONLY LIMITING RESOURCE.

tions which completely utilize spring land. Then we could compute the quantities of the other resources needed at the end points of the spring land line. If the quantity of a particular resource needed at each end point corresponding to the allocation of the entire land resource to each process in turn) is less than the amount available, then it is clear that this resource is not an effective bottleneck. For example, 50 units of p_1 or 43 units of p_2 would utilize 100 per cent of the spring land resource. These two alternative allocations would require only 41 per cent and 26 per cent of the available labor supply in January-February. Thus, relative to spring land, this resource is not an effective bottleneck. Spring land is completely utilized before January-February labor.

With this background, it is now possible to generalize our results. Construct a graph with the vertical axis measuring the percentage of spring land utilized and the horizontal axis measuring the percentage of January-February labor utilized. (see Fig. 2.) Now plot on this graph the points corresponding to 10 units of each of the six processes. For example, 10 units of p_1 uses 19.984 per cent of spring land and 8.199

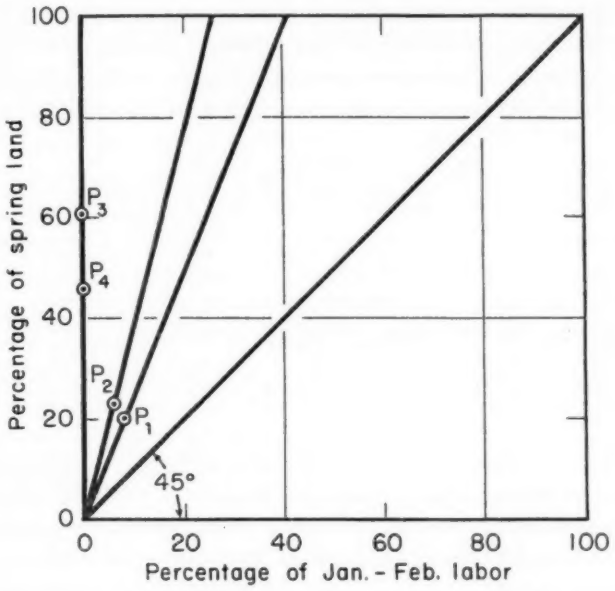


FIG. 2. GRAPHIC DETERMINATION OF THE PERCENTAGE OF JANUARY-FEBRUARY LABOR REQUIRED FOR ALTERNATIVE ALLOCATIONS OF 100 PER CENT OF SPRING LAND TO EACH OF THE PRODUCTIVE PROCESSES REQUIRING SPRING LAND.

per cent of January-February labor. Ten units of p_2 use 23.036 per cent of spring land and 6.064 per cent of January-February labor, etc. Now expand each process in turn to completely utilize the spring land resource. This is done graphically by extending a straight line from the origin through each plotted point to the horizontal line representing 100 per cent utilization of the land. If a process does not use any spring land, the corresponding line would coincide with the horizontal axis and, of course, would never intersect the line representing 100 per cent of spring land. Notice, however, that in this illustration every process that uses spring land exhausts the land resource before January-February labor is completely utilized. Therefore, relative to spring land, January-February labor is in excess supply and need not be considered further in developing an optimum combination of processes. Draw a 45° line

from the origin. If every plotted point lies above or on this line, the resource measured on the horizontal axis is in surplus supply relative to the resource measured on the vertical axis. If every plotted point lies below or on the line, the resource measured on the vertical axis is in surplus supply. If some points fall above and others below, then both resources are potentially limiting. What does this mean algebraically? For all the plotted points to lie above or on the 45° line, every coefficient in the spring land row must be larger than or equal to the corresponding element in the January-February labor row. Thus, in order to identify surplus resources, it is only necessary to compare every pair of rows and to delete from further consideration any row all the coefficients of which

TABLE 3

Resources	Processes					
	1	2	3	4	5	6
Spring land (1)	1.9984	2.3036	6.1050	4.6264	0	0
Fall land (2)	0	2.3036	6.1050	4.6264	0.8042	0.3663
Production capital (3)	5.9592	2.6088	3.6172	3.7752	1.8034	0.5824
September-October labor (4)	0	0	0.3767	0	2.1736	0.6408
November-December labor (5)	0	1.1550	0.3714	0	1.2231	1.6368

are less than or equal to the corresponding coefficients of some other row. Comparing the spring land row of Table 2 with all of the other rows, labor in the first three time periods is in surplus supply and can be deleted. In addition, all the coefficients of row 7 are less than or equal to the coefficients of row 3, so row 7 can be deleted. All other paired rows contain inequality reversals and thus must be retained. So, rather than consider nine limiting resources, we now need to consider only five. Table 3 lists the modified processes. Resources have been renumbered.

At this point the processes are inspected to see if it is necessary to include all of them for further analysis. "Inefficient" processes should be deleted. The concept of an inefficient process is also most clearly illustrated for a simpler problem. Suppose that the only limiting resources are land and production capital and that only two processes, corn and soybeans, p_2 and p_3, are considered. The coefficients in Table 3 for these resources and processes indicate that it requires 6.1 per cent of the available land and 3.6 per cent of the available production capital to grow enough soybeans to yield $100 net cash return, while it takes only 2.3 per cent of the land and 2.6 per cent of the production capital in corn to yield the same amount. Under these conditions, it is inefficient to use the limited resources to produce soybeans. On the other hand, if soybeans and beef were compared on the same basis, soybeans require more

land per $100 of net cash return but slightly less production capital. Further analysis would be needed to select the best combination.

The rule is to make a comparison between each pair of processes. If every coefficient of a standardized process is larger than or equal to the corresponding coefficient of the other standardized process, then the first process is inefficient and should be deleted. Pairwise comparison of the processes in Table 3 indicates that none of the six processes are inefficient in this sense. Per unit of net cash return—corn, for example—requires less land, less production capital, less September-October labor, but more November-December labor than does soybeans. Inequality reversals of this kind indicate that both processes must be retained for further analysis. Had some processes been rejected as inefficient, it would have been necessary to check the rows once again to see if the reduction in the number of processes makes it possible to reduce the number of resources considered.

The problem has now been reduced to the smallest possible dimensions. It is now artificially extended by defining five "disposal" processes, one for each of the resources retained.[9] p_7 is a disposal process for spring land. One unit of p_7 uses 1 per cent of the available spring land and no other resources. p_8 uses 1 per cent of the available fall land no other resources, etc. These disposal processes make it possible to specify that every program will use completely all the resources available. The next step is to find a "feasible" program, one which uses all the resources, and then develop a set of vector equations. Each vector equation specifies the particular combination of processes included in the first program which utilizes the same quantities of resources as a process. The method of analysis presented here always starts with a program composed of disposal processes.[10] The resulting set of vector equations is listed in Table 4. Ones are listed in the c_j row to simplify further computations. This means that net cash return is measured in $100 units.

The c_j row and column list the "value" of one unit of the corresponding process. Disposal processes have zero value. The column under p_0 should be read as a vector equation. p_0, the vector listing the available resources, is equal to 100 units of p_7 plus 100 units of p_8 plus 100 units of p_9 plus 100 units of p_{10} plus 100 units of p_{11}. The economic interpretation is that this equation represents the first feasible program. All the resources are allocated to the five disposal processes. The column under p_2 should also

[9] It is assumed that the reader is familiar with the content and notation of Boles, *op. cit.*, or Charnes, *et al.*, *op. cit.*

[10] The definition of disposal processes makes it possible to write the first set of vector equations without any computation. Notice that the coefficients of the equations in Table 4 are the same as those of Table 3.

TABLE 4

c_j			0	0	0	0	0	1	1	1	1	1	1
	p_j	p_0	p_7	p_8	p_9	p_{10}	p_{11}	p_1	p_2	p_3	p_4	p_5	p_6
0	p_7	100	1	0	0	0	0	1.9984	2.3036	*6.1050	*4.6264	0	0
0	p_8	100	0	1	0	0	0	0	2.3036	*6.1050	*4.6264	0.8042	0.3863
0	p_9	100	0	0	1	0	0	*5.9592	*2.6088	3.6172	3.7752	1.8034	0.5824
0	p_{10}	100	0	0	0	1	0	0	0	0.3767	0	*2.1736	0.6408
0	p_{11}	100	0	0	0	0	1	0	1.1550	0.3714	0	1.2231	*1.6368
z_j		0	0	0	0	0	0	0	0	0	0	0	0
$z_j - c_j$		0	0	0	0	0	0	−1	−1	−1	−1	−1	−1

be read as a vector equation: $p_2 = 2.3036\ p_7 + 2.3036\ p_8 + 2.6088\ p_9 + 0\ p_{10} + 1.1550\ p_{11}$. z_2 is the "value" of this combination of processes: $z_2 = 2.3036\ c_7 + 2.3036\ c_8 + 2.6088\ c_9 + 0\ c_{10} + 1.1550\ c_{11}$. Since the first program includes only disposal processes, all the corresponding c's are zero and all the z's are zero. The negative entry in the $z_j - c_j$ row under p_1 means that net cash return would be increased by one unit, \$100, if enough resources were taken from the processes in the current program to activate one unit of p_1.

The next step is the selection of a productive process to replace one of the disposal processes in the current program. The modified criterion used is the same for all intermediate tables: *Pick the process that, when introduced into the current program, will result in the greatest total increment of net cash return.*

In general, to determine the increment of net cash return associated with the introduction of a process, it is necessary to show (1) the net value of the unit process relative to those it will displace, the entry in the $z_j - c_j$ row, and (2) how many units of the process in question can be introduced into the program before displacing completely one of the processes currently used.

Since the standardized processes in Table 4 all have the same value, only the second question needs to be considered at this point. In order to determine how many units of a productive process, say p_1, can be introduced, it is necessary to consider the ratios formed by dividing the entries under p_0 by the corresponding coefficients of p_1.[11] The row in which the smallest ratio is found identifies the process in the current program which would be replaced by the introduction of p_1. Since the entries under p_0 are all equal to 100, the smallest ratio is found by selecting the largest coefficient of p_1, 5.9592. Thus, if p_1 is introduced into the basis, p_9 would be replaced and 16.8011 units of p_1 would be used to increase net cash return from \$0.0 to \$1,680.

In Table 4, the largest coefficient of each process is starred. The smallest starred coefficient identifies the process which would result in the largest total increment of net cash return. p_6 has the smallest starred

[11] Process coefficients which are zero or negative are ignored.

TABLE 5

c_j	p_j	p_0	0 p_7	0 p_8	0 p_9	0 p_{10}	0 p_{11}	1 p_1	1 p_2	1 p_3	1 p_4	1 p_5	1 p_6
0	p_7	100	1	0	0	0	0	1.9984	2.3036	6.1050	4.6264	0	0
0	p_8	77.6210	0	1	0	0	−0.2238	0	2.0451	*6.0219	*4.6264	0.5305	0
0	p_9	64.4184	0	0	1	0	−0.3558	*5.9592	*2.1979	3.4851	3.7752	1.3682	0
0	p_{10}	60.8505	0	0	0	1	−0.3915	0	−0.4521	0.2313	0	*1.6947	0
1	p_6	61.0948	0	0	0	0	0.6109	0	0.7056	0.2269	0	0.7473	1
z_j		61.0948	0	0	0	0	0.6109	0	0.7056	0.2269	0	0.7473	1
$z_j - c_j$			0	0	0	0	0.6109	−1	−.2944	−0.7731	−1	−0.2527	0
Limiting ratio								10.81	29.31	12.89	16.78	35.91	
Total increment of net cash return								10.81	8.63	9.97	16.78	9.07	

coefficient so 61.0948[12] units of p_6 replace p_{11} and net cash return is increased from \$0.0 to \$6,109.

Table 5 contains the second set of vector equations. The negative values in the $z_j - c_j$ row indicate that net cash return can be increased by introducing any of the other productive processes. The problem is to identify the one which will result in the largest total increment of net cash return. The first step is to identify the limiting ratio for each process having a negative entry in the $z_j - c_j$ row. Since the entries under p_0 are no longer all the same, some computation may be necessary. For example, consider the introduction of p_1 into the current program. Each entry under p_0 is divided by the corresponding coefficient under p_1. Zero or negative coefficients of p_1 are ignored. The two ratios are $100/1.9984 = 50.04$ and $64.4184/5.9592 = 10.81$. The smaller of these two ratios indicates that the introduction of 10.81 units of p_1 would utilize all the resources currently used by p_9, the row in which the smallest ratio appears. Starred coefficients in Table 5 identify the ratios which limit the introduction of the corresponding processes. The ratios are entered in the next to last row. They indicate the maximum number of units of the corresponding processes which can be introduced to displace completely one process in the current program. These ratios multiplied by the increment in net cash return per process unit, the corresponding entry in the $z_j - c_j$ row (disregarding sign), give the total increments in net cash return. Since the introduction of p_4 results in the largest total increment in net cash return, p_4 replaces p_8 and net cash return is increased from \$6,109 to \$7,787.

Table 6 lists the new set of vector equations. Note that, due to the standardization of net cash return per process unit, the z_j row is computed by simply adding the coefficients in the rows corresponding to the productive processes in the basis.[13] Only two processes, p_1 and p_5, have

[12] $61.0948 = \dfrac{100}{1.6368}$

[13] For example, $p_2 = 0.2587\ p_7 + 0.4420\ p_4 + 0.5293\ p_9 - 0.4521\ p_{10} + 0.7056$

negative entries in the $z_j - c_j$ row. The introduction of p_1 to replace p_5 is the final step, yielding Table 7.

TABLE 6

c_j	p_j	p_0	0 p_7	0 p_8	0 p_9	0 p_{10}	0 p_{11}	1 p_1	1 p_2	1 p_3	1 p_4	1 p_5	1 p_6
0	p_7	22.3792	1	−1.0002	0	0	0.2239	1.9984	0.2587	0.0833	0	−0.5306	0
1	p_4	16.7778	0	0.2162	0	0	−0.0484	0	0.4420	1.3016	1	0.1147	0
0	p_9	1.0788	0	−0.8162	1	0	−0.1731	5.9592	0.5293	−1.4287	0	0.9352	0
0	p_{10}	60.8505	0	0	0	1	−0.3915	0	−0.4521	0.2313	0	1.6947	0
1	p_6	61.0948	0	0	0	0	0.6109	0	0.7056	0.2269	0	0.7473	1
	z_j	77.8726	0	0.2162	0	0	0.5625	0	1.1476	1.5285	1	0.8620	1
	$z_j - c_j$		0	0.2162	0	0	0.5625	−1	0.1476	0.5285	0	−0.1380	0
Limiting ratio								0.1810				1.1536	
Total increment of net cash return								0.1810				0.1592	

TABLE 7

c_j	p_j	p_0	0 p_7	0 p_8	0 p_9	0 p_{10}	0 p_{11}	1 p_1	1 p_2	1 p_3	1 p_4	1 p_5	1 p_6
0	p_7	22.0175	1	−0.7264	−0.3353	0	−0.2819	0	0.0812	0.5623	0	−0.8441	0
1	p_4	16.7778	0	0.2162	0	0	−0.0484	0	0.4420	1.3016	1	0.1147	0
1	p_1	0.1810	0	−0.1370	0.1678	0	−0.0290	1	0.0888	−0.2397	0	0.1569	0
0	p_{10}	60.8505	0	0	0	1	−0.3915	0	−0.4521	0.2313	0	1.6947	0
1	p_6	61.0948	0	0	0	0	0.6109	0	0.7056	0.2269	0	0.7473	1
	z_j	78.0536	0	0.0792	0.1678	0	0.5335	1	1.2364	1.2888	1	1.0189	1
	$z_j - c_j$		0	0.0792	0.1678	0	0.5335	0	0.2364	0.2888	0	0.0189	0

Table 7 gives the optimum allocation since there are no negative entries in the $z_j - c_j$ row. The optimum program consists of 0.1810 units of p_1, 16.7778 units of p_4,and 61.0948 units of p_6, yielding \$7,805 net cash return.[14]

The application of the modified criterion does not depend upon standardization. However, standardization has the following virtues:

(1) Resources that will be surplus for all feasible programs can be identified by inspection and deleted.
(2) Inefficient processes can be identified by inspection and deleted.
(3) Coefficients can be adjusted to a form that is computationally convenient.
(4) The best single process and the corresponding bottleneck resource can be identified by inspection.
(5) The z_j row is computed by adding process coefficients rather than by multiplying the coefficients by nonstandardized net cash returns per process unit and then adding.

p_6. $z_3 = (0.2587)(0) + (0.4420)(1) + (0.5293)(0) - (0.4521)(0) + (0.7056)(1) = 0.4420 + 0.7056 = 1.1476$.

[14] Since this paper is concerned primarily with computational technique, no further economic interpretation is made.

TEACHING ECONOMICS IN COLLEGES AND UNIVERSITIES*

GEORGE K. BRINEGAR
University of Connecticut

I. Introduction

I START with the belief that teaching is the most important activity of a university and therefore of the individual staff members. My desire to discuss this topic flows from the importance of the subject and the belief that it is desirable to make an occasional reappraisal of the subject rather than from the notion that I can resolve most of the questions.

In this discussion an attempt will be made to show the nature of courses that can be offered in economics, why blends of these alternatives are inferior to the straight bonded components, and the gains that can be realized if the portions are taken in the suggested order. Additionally, special attention is directed toward the problem of students wishing to become specialists such as agricultural economists. More specifically I am going to advance the propositions that (1) the subject matter which can be presented in economics courses consists of (a) economic history, (b) analytical tools and (c) applied economics, which can be examined at almost any level of detail or generality, with almost any degree of rigor or sloppiness by almost any group of students, (2) courses in economics can be most effectively taught if they consist of the above subjects in their pure forms rather than if the courses are organized to examine cross sections of these subjects, (3) students should be exposed to economics courses in the order listed above and (4) such a structuring of courses is also appropriate for students wishing to become specialists.

II. Types of Subject Matter or Courses to be Offered[1]

Economic history, a usually neglected subject in the education of economists and others, is the source of all empirical data economists use. It provides the gravel with which the tools of economic analysis are designed to deal, and it is the thing the applied economist attempts to make different in the future than it otherwise would have been.

---

* Paper presented at the annual meeting of the New England Agricultural Economics Council, June 27-29, 1956, Kingston, Rhode Island.

[1] A comment is in order on the definitions of the three terms—economic history, analytical tools, and applied economics—though no useful purpose would be served in this paper to arbitrarily spell out exclusive and exhaustive definitions. Economic history is intended to include materials that are largely descriptive in a census or history book type of way, while the phrase analytical tools is intended to include the materials usually included in text books on the theory of statistics and economics, and applied economics is intended to refer to the use of economic history and analytical tools, as well as other materials, in the working out of predictions and of specific problems as an aid in decision making.

The main problem in designing a course or engaging in the study of history is to decide what history is relevant. The relevancy problem is not solved even if the position is taken that all knowledge is good independent of its use, if any—the problem still remains of where to start, facing up to the fact a person has neither the time nor the ability to know everything. While this problem is insoluble in a literal and complete sense, its partial solution is not only possible but is, for better or worse, reached each time a person reaches a choice of which facts to study.

The following types of material are, and in the writer's opinion should be, covered in courses at the undergraduate level dealing with economic history. High on this list would be long-term trends in population, technology, resources, income, wants and prices. Other areas of interest would cover more specialized fields such as agriculture, money and banking, labor, national development, public finance, business cycles, transportation, marketing, industry and area development etc., as well as the history of economic thought.

The purpose of such courses would be largely that of an examination of past trends and events with only ancillary attention devoted to analytical tools and applications.

The analytical tools that economists use are in the main the same as are used in most other analytical studies. They are easy to describe and recognize but usually very difficult to employ except on the most elementary problems. The most general of these tools are the ones a college teacher hopes he can assume have been mastered, such as reading, writing, arithmetic, logic and even remembering. The more specialized tools of analysis used by economists concern supply and demand, maximization, at the micro and macro levels and national income determination. The analytical tools economists have with which to work on historical change, if judged by the product, require a bit of development and polishing before they can be formally treated in elementary economics courses.

In designing economics courses at the college level it is probably necessary and desirable to expect students to demonstrate high levels of proficiency in the use of the most general tools, e.g. reading, writing and arithmetic, and to design courses around the more specialized tools used by economists. The most elementary of these tools consist of supply and demand analysis which should likely be taken first. The second area is that of maximization which includes the theory of the firm and household as well as welfare economics. The third major area is that of national income determination which would also include business cycles, interest rates and capital formation.

A tool used by economists, general in nature, which is used in supply and demand analysis, maximization questions, and national income determination problems is that of mathematics, statistics and econometrics. Proficiency in these areas can likely best be developed through specific courses, in some cases designed largely for economists. These courses could well be taken along with the more purely "economics" courses, and with the exception of mathematics, after the introduction to economic history.

Applied economics is the queen of the science, if it is a science, and a tyrannical madam is the queen. At the undergraduate level few students will ever be qualified to take more than the most elementary courses in applied economics for here we go beyond a description of the past, beyond the ceteris paribus assumptions which make theory easy, and beyond self-contained systems of numbers. In applied economics an attempt is made to go beyond economic history—to predict it—and of necessity to be later checked upon by an unfolding of economic history.

Many of the courses now bearing the label of applied economics at their worst are usually "wrong" economic history and at their best, exercises in logic with the use of assumptions as a means of avoiding the hard problems which must be faced if projections into the future are to be made. The writer is not acquainted with any "real" applied economics courses now being given at the undergraduate level with the exceptions of an occasional seminar and a few special investigation courses. This is probably as it should be in that it is usually not practical to try to be practical in the field of economics except after a person has had very considerable training in economic history, theory, and statistical measurement and inference techniques.

III. The Bonds Rather than the Blends

In this paper the proposition is advanced that economics courses should be specialized with reference to their content rather than blends of economic history, analytical tools and applied economics. This proposition is advanced because the types of thinking required for effective work in the areas of economic history, theory, and applied economics differ significantly. Moreover, a person thinking in the frame of reference of an economic historian could not function effectively as a theoretical or an applied economist. The applied economist in his thinking and analysis can abstract from nothing in his final conclusions and must not only be prepared to drop his "if conclusions" but to take into account non-economic considerations. The person working with the formal analytical tools of economists can attain a rigor, through the use of conditional statements, impossible for the historian and the applied econo-

mist. The economic historian's job is easy compared with that of the applied economist because his center of interest is with facts, after the fact, rather than with the future and notions of what ought to be. The theorist, on the other hand, has an easy job compared with the economic historian because he can proceed forthright in the absence of facts, through the use of conditional statements, in reaching conclusions.

In my own experience I have seen more students and others get into trouble because of their failure to distinguish whether they are acting as if they were historians, theoreticians or applied economists than for any other reason. A continual jumping back and forth from fact to abstraction to application leads to confusion in thought and misunderstanding unless both writer and reader are made explicitly aware of these changes. Thus I conclude that at the undergraduate level, at least, courses should be built around these separate types of thinking processes rather than on cross sectional cuts across them. This statement is not intended to suggest it is desirable to completely exclude history and application when theory is the center of interest nor should complete exclusions of the other areas be made when applied economics or history is the center of interest. Diversions from the central theme of the course, however, should be clearly and explicitly labeled as such.

IV. Ordering of Subject Matter

The proposed ordering of these subjects is that of economic history, theory and analytical tools, and applied economics. The test or criteria for ordering courses is that of usefulness—if the test were knowledge, any knowledge for its own sake, there would be little basis for a reasoned choice of a starting point.

In the writer's opinion, the starting place in the study of economics at the undergraduate level is economic history. This choice is based upon the following considerations: (1) economic history is readily teachable to heterogeneous groups, (2) economic history provides a useful background for a further study of economics, and (3) economic history can be used for prediction purposes with the simplest of all predictive tools.

Economic history is more nearly teachable to heterogeneous groups than is theory or applied economics. About the only ability required of a student to handle economic history is to be able to read and to listen to an instructor, abilities more widely found than the ones required in theory and applied economics. Moreover the information dealt with is of a type students are likely to be already familiar with which is not usually the case with theory and applied economics.

A study of economic history as an initial course also provides an excellent background for the student wishing to study additional economics.

First, he learns factual information on which he can draw when studying theory or applied economics. Second, he has had a peek into the area of economic analysis and prediction, and third he has the beginnings of a frame of reference within which he can fit more advanced study.

A simple analytical tool is available for use in prediction from a knowledge of historical trends and constants. This analytical tool consists of assuming, in its least complicated form, that tomorrow will be like yesterday. Probably the first refinement in this analytical tool would be to drop the assumption that the magnitude is a constant and to use the substitute assumption that the direction or, one step more complex, that the rate of change is constant. From this point the analysis can be complicated further by looking at the change in the rate of change etc., but when this path is followed, we soon pass into the area usually labeled "theory." From these considerations, it follows that the student taking only one economics course, one in economic history, will gain knowledge and a method of analysis, admittedly simple, that will be useful in the future applications he may wish to make.

The second area for study by undergraduates in economics consists of concentration on the analytical tools used by economists—theory and statistics. At this point it can be assumed that many students will discontinue their interest in economics. As a consequence this group of courses should be organized on the assumption that the students have a "real" interest in economics and will take additional work in the field. Thus, at this point, an effort should be made to make economists out of the students rather than to tell students something about economics.

At this level a sequence of 9 semester hours of credit for undergraduate students is the recommended minimum. Supply and demand analyses; maximization problems, including the theory of the firm and household as well as welfare economics, and distribution theory; national income determination; and statistics should be treated.

The third and final step in the education of an economist at the undergraduate level should be in applied economics. A course of this type should be based on the assumption the student has a good grounding in economic history, theory and statistics. A course of this type might consist of two parts. Part one would consist of evaluating applied studies and part two, the making of such a study or studies by the class.

V. *Specialist Training Under Suggested Program*

The final proposition advanced in this paper is that persons wishing to become specialists in some branch of economics will profit most if the courses they take are structured in the pattern suggested. In order to investigate this proposition the following questions are examined: (1)

what is the difference between an economist with a specialty and an economist without one? (2) how does an economist become a specialist? and (3) what contributions can be made in the class room in training specialists?

A person considered to be specialized in agricultural economics, labor, statistics, money and banking, public finance, etc., is first an economist rather than first a tax collector, a banker, a statistician, a laborer, or a farmer, with a few courses and some study of economics. The economist with a specialty is different from the general economist with reference to the additional training he has had, and knowledge he has, rather than with respect to a substitution of specialty training for training in general economics or other areas. The additional knowledge of the specialist is largely of the types classified as economic history and applied economics rather than in the area of formal analytical tools. If this concept of the specialist is accepted it follows that the "Education" of the specialist is similar to that of the general economist except for something additional that must be added.

How does an economist become a specialist? is a question with no unique answer. The additional knowledge of the specialist, in his area of interest, has usually been acquired in more than one of the following three ways: (1) past experience prior to becoming an economist, (2) formal course work, and (3) independent study and on-the-job training. The first method of obtaining some of the knowledge required for being a specialist is probably the least significant with reference to the expertness, though likely the most significant factor contributing to the selection of an area for specialization. If agriculture is used as an example, it can be shown that most farm management specialists have grown up on farms, but that growing up on a farm is in no way an adequate qualification for being a farm management specialist. Formal course work, a second road to specialization, can provide useful knowledge to a person wishing to specialize in some branch of economics. However, an exclusive use of the class room to train specialists is a costly procedure and is not to be recommended on this basis. The most widely used and efficient method of developing specialization in economics is that of on-the-job training and independent study, and consequently the method to be favored in most instances. These are the approaches a person, with an adequate background as a general economist, can follow to join the ranks of the specialist or expert.

The contribution of the class room in the training of persons desiring specialties in economics is first that of training able general economists. If this job is well done a first and indispensable step has been taken. The class room stands out as an efficient technique for helping persons

to learn economic history and theory or analytical tools. The class room can also be effectively used in teaching applied economics, but costs start increasing at a rapid rate in terms of expenditures per student-class-hour. These costs are high for two reasons. First, an adequately conducted course in applied economics requires a relatively large amount of instructor time per student. Second, the market places a relatively high price on the time of a person with the ability to adequately teach a course in applied economics. The costs of training specialists in the class room are higher than that of training applied economists. These costs are high for the same reasons the costs of training applied economists are high, but more costly since even more time is required of the instructor on a per student basis.

If the concept of the specialist used above is accepted and the costs of gaining the additional knowledge required of the specialist are as suggested, the class room does not appear to be the place to develop finished specialists. The class room is the place to provide instruction to persons wanting to become specialists—to prepare them to develop their specialties on their own but not the place to make them. More specifically, the place of class room teaching is to develop in students a knowledge of economic history, theory or analytical tools, and applied economics but to only start on the path to specialization. The development of a full-blown specialty can most efficiently grow out of independent study and research in the area of the economist's interest.

VI. Conclusions

At the undergraduate level the teaching of economics should be designed so that students with a casual as well as a major interest in the field can be accommodated. The materials presented show that the same pattern of courses, if designed around economic history, theory and analytical tools, and applied economics, will be effective in serving both groups, individually and together.

The recommended procedure is for the first courses to concentrate on economic history. The second group to be pointed toward theory and the other tools of analysis, and the third group toward applied economics.

The basis for structuring the courses in the suggested way stems from the types of mental activity required of persons concerned with economics. The test of this structuring of courses is how well it works.

AN ANALYSIS OF THE FIRST INTERIM REPORT OF THE NEW HOUSE SUBCOMMITTEE ON FAMILY-SIZE FARMS

NORMAN F. KEISER*
New York Teachers College, Oswego, N.Y.

Introduction

THE family farm has occupied a high position in our scale of values. Not only has it been a value in and of itself but it is also claimed to be a vehicle for the realization of other typically American values. Some maintain, for instance, that the family farm has been the dominant source of our political liberties and our democratic form of government, of our spiritual values and attitudes, of our individualistic values (and the accompanying desire to run our own businesses and be our own bosses), of our motivation to work hard and be successful, of our spirit of community participation, and of our "free enterprise system." In fact it is sometimes argued that the continuation of our "free enterprise system" is dependent upon the perpetuation of the family farm.

The family farm as an economic, political, and social goal has a long history, going as far back as the early days of land settlement in this country. In early New England, for example, land was apportioned according to how much a settler and his family could farm. In the Old South a settler was granted a minimum of fifty acres (which was enough for the average family in those days) under the Headright system. The importance of the family farm as the goal of national policy is pointed out by a cursory examination of federal land policies. Congress in the 1800's recognized squatters' rights, sold land to family settlers quite inexpensively, and ultimately gave it to homesteaders. More recently Congress has seen fit to base irrigation and reclamation projects on a family-size basis; establish extensive (but not necessarily adequate) credit facilities, the FSA and the FHA, the Extension Service and the agricultural experiment stations; and make sizeable grants for education and research —all for the purpose of aiding the family (and in some cases other) farmers.[1]

The family farmer is plagued with many problems, most of which result in a low income and a low standard of living for him. These problems include a cost-price squeeze wherein the prices of the products he sells are declining while the prices of products he buys have been increasing; he has suffered cuts in his acreage allotments which have in

* This paper was prepared while the author was at Michigan State University.

[1] Harold Halcrow, *Agricultural Policy of the United States*. New York: Prentice-Hall, 1953, pp. 192-94.

turn reduced the returns on his cash crop; many who voluntarily diversified or rotated crops suffered more serious cuts in allotments which were very significant to them since the prices of products to which they switched (at considerable cost in many cases) have in many cases fallen sharply; many cannot diversify because they lack markets or marketing or grading facilities; a great number just do not have enough land and equipment on which to make a decent living and credit in too many instances (for machinery, land or homes) is too difficult to secure, too expensive and too short term; many of these farmers are underemployed; many are poorly trained and their farms therefore poorly managed; and many have access to only inferior and inadequate health, educational and recreational facilities.

It is appropriate at this point to cite data indicating (1) certain trends relevant to the family farm problem and (2) the magnitude of this problem. In the gross farm income category of $400-1,499 there were in 1945 some 2,012,000 farm families. Approximately half of these individuals were classified as underemployed (without important sources of off-farm income). Of this number 57% were owner-operator families and 43% were tenants.[2] From the standpoint of all farms the following statistics point out certain significant tendencies:[3] The farm population dropped from 1947 to 1954 from 27,124,000 to 21,890,000. It declined from 35% of the population in 1910 to 13.5% of the population in 1954. The importance of this trend becomes quite significant when one notes that the loss from 1947 to 1954 was greater than in the entire preceding 37 years. Or, put on a more recent basis, 600,000 farm units vanished between 1950 and 1954. This was almost twice the decline which occurred during the 20 year period from 1920-40. In recent years the disappearance of farms has taken place among those of 259 acres and less. On the other hand, there has been a significant increase in the number of farms of 260 acres and above. The total amount of labor used in farming has declined about 35% since 1910 while production per hour of farm labor has almost tripled. Capital investment per worker in agriculture, at 1947-49 prices, has increased from somewhat under $8,000 in 1940 to considerable more than $12,000 at the present time. Since 1930 the number of farms over 500 acres in the South has almost doubled, moving from 23,000 to 43,000. This trend towards larger farm size has been quite similar in the North

[2] Most of those with incomes under $400 had substantial nonfarm incomes. U.S. Congress, Joint Committee on the Economic Report, *Underemployment of Rural Families*. 82d Cong., 1st Sess., Washington, D.C.: Government Printing Office, 1951, pp. 13-14.

[3] U. S. Congress, House, *First Interim Report*, Subcommittee on Family Farms of the Committee on Agriculture. 84th Cong., Washington: Government Printing Office, 1956, p. 10.

and even more pronounced in the West and Plains States.[4] These trends have an obvious relevancy for family farms.

Further significance results from the following more specialized statistics.[5] Of families with net income under $1,000 in 1942, 41% were located in the South and of 95 counties in Tennessee 93 have been classified by the USDA as disadvantaged areas;[6] from 1950 to 1955 in a 35-county area of eastern and northeastern Texas the number of farms dropped by approximately 16%;[7] in Louisiana from 1935 to 1955 the number of farms dropped from 161,000 to 124,000 while the average size increased by 35%, from less than 60 to just over 90 acres.[8]

Also important for reasons to follow are some statistics relative to the distribution of cotton allotments. In 1955 the national average per farm was estimated at 18 acres (this does not include tenant farmers).[9] The following statistics were offered for Cherokee County, Texas, for the 1955 cotton allotments.[10]

Amount under 1 acre	.01	.02	.03	.04	.05	.06	.07	.08	.09
Allotment (total-63)	1	10	4	12	9	8	5	12	2

In this same county of 1,925 applicants for cotton allotments only 783 received more than 5 acres.[11] In Tishomingo County, Mississippi, over half of the 2,000 farms had allotments under 5 acres.[12] In Hardin County, Tennessee, 60% of all cotton farmers had allotments under 5 acres. In this particular context it is important to note that in 1954 the parity price for cotton was 34.72 cents per pound basis Middling average, so that the 5-acre man at full parity would have an income from cotton of $520.20, not including seed; 90% of parity would have given him $468.72.[13]

In line with the above mentioned values which are attributed to the family farm, in view of the problems with which the family farmers are confronted, and as a continuation of our national policy to perpetuate

---

[4] U. S. Congress, House, *Family-Size Farms*, Hearings before the Subcommittee on Family Farms of the Committee on Agriculture. 84th Cong., 1st. Sess. (October 7, 8, 10, 11, 18, 1955), Washington: Government Printing Office, 1956, pp. 3-4.

[5] The lack of constancy in statistics is a reflection of the lack of constancy in the supervision of the hearings. Under the circumstances they are presented only to throw some light on the magnitude of the general problem.

[6] The income of a large portion of the farm population is too low to provide what is assumed to be a satisfactory living for the farm family.

[7] *Family-Size Farms*, p. 122.

[8] *Ibid.*, p. 133.

[9] *Ibid.*, p. 21.

[10] *Ibid.*, p. 82.

[11] *Ibid.*, p. 207.

[12] *Ibid.*, p. 279.

[13] *Ibid.*, p. 207. In 1954, 31.3% of the cotton farmers planted less than 5 acres, and 31.7% between 5 and 14.9 acres, making 63% of the cotton farmers with less than 15 acres. Cotton Division, Commodity Stabilization Service, USDA.

the family farm, the chairman of the House Committee on Agriculture created the Subcommittee on Family-Size Farms on August 5, 1955. The purpose of this paper is to analyze the first hearing conducted by this new subcommittee and to compare the results of the hearings with the subcommittee's *First Interim Report.*

Origin and Purpose of the House Subcommittee on Family Farms

The Family Farms Subcommittee was set up

> To make a special study of the ways and means to protect, foster, and promote the family farm as the continuing dominant unit in American agriculture, with special attention to the manner in which we can adjust our farm programs to accommodate the convenience, productivity, and prosperity of the family farm unit.[14]

To this was added a related objective as revealed in a statement of one of the subcommittee members to a witness—"we are down here for one main reason of trying to find out why so many people are leaving the farms."[15] A newspaper editorial further elucidated the purposes of the subcommittee hearings when it stated that the "committee hopes to learn how and why . . . the family-operated farms are bearing the brunt of the sharp drop in income that has resulted from the cost-price squeeze in virtually all areas of agriculture. Secretary Benson has said that corporation profits and industrial workers' earnings have been going up while farmers' income has been going down. If that situation isn't corrected, several million farm voters will be after somebody with a pitchfork in 1956."[16] This editorial comment, while both serious and amusing at the same time, was endorsed and entered into the record by the subcommittee chairman.

It was the intention of the subcommittee to go directly to the farmers in order "to hear in their own locations and in their own words the cause of this distress and the extent of their thoughts that might suggest remedy."[17] Accordingly the subcommittee traveled some 3,000 miles to hold sessions at Hallettsville, La Grange, and College Station, Texas; Baton Rouge, Louisiana; Troy, Alabama; Fulton, Mississippi; and Pulaski, Tennessee. Other special conferences with farmers and their leaders were held in different sections of the South, but the results of these sessions were not made available to the author at the time this analysis was done.

In the selection of witnesses there was no general pattern, although in some cases they were assigned topics to discuss. Furthermore, organizations (including farm organizations) were supposedly excluded from

[14] *First Interim Report,* pp. 1, 2.
[15] *Family-Size Farms,* p. 181.
[16] *Ibid.,* p. 3, quoting from the *New Orleans State,* September 27, 1955.
[17] *First Interim Report,* p. 2.

testifying but in actual fact were not. A discussion of an attempt to secure more data on the selection and instruction of witnesses appears in the section below, which evaluates the manner in which the hearings were conducted. It would no doubt be quite significant to have more information on this point in view of the forthcoming analysis of the attitudes and beliefs of the farmers, but such was not available.

An Analysis of the Hearings

In analyzing the background of the witnesses who participated in the hearings the following categories were developed:

Category		Number
1. Farmers		148
a. cotton (diversified)	58	
b. cotton only (or unknown if diversified)	62	
c. general	28	
2. Government (agricultural and allied)		22
3. Representatives of farm organizations		19
4. Businessmen		10
5. Government officials (general)		4
6. Priests		4
7. Ginners		2
8. Unknown		2
Total		211

A large number of cotton farmers engaged in diversified production. No doubt many of the 62 farmers classified under "cotton only (unknown if diversified)" were also diversified but such information was not brought out. Also, there were two groups (of 24 and 9 farmers) who signed the same statements classified under this latter category since it was indicated that they produced cotton but unknown if they were diversified. The category entitled "government (agricultural and allied)" included people from agricultural experiment stations, the extension service, agricultural education, commissioners of agriculture, agricultural councils, county agents, 4-H clubs, FFA, and universities. Farm organizations included the Farm Bureau and representatives of producers of peanuts, milk, and tobacco. The remaining categories are self-explanatory.

The attitudes and beliefs recorded below were those of the individuals included in the above categories and not the members of the subcommittee. The following classification is based on the realization that there probably was no uniform pattern of assigning witnesses topics to discuss, that there were variations in the solicitation and elicitation of responses from witnesses, and that there were real problems of codifying and attempting to record reactions of witnesses.[18]

[18] The writer merely wanted a rough sampling of the attitudes and beliefs of the witnesses at the hearings and further felt that there was a point of diminishing re-

Response	Number times tallied
1. Concerned over the cost-price squeeze	118
2. Acreage allotment reduction is very harmful to small farmers' incomes	101
3. Small farmers need more and better credit	79
4. Minimum price supports should be continued	61
5. Favored the continuation of acreage controls	34
6. The farmer deserves his fair share of the national income and a decent standard of living	33
7. There should be minimum acreage allotments for small family farms	28
8. More money should be spent for conservation and soil building	25
9. Concerned over the number of people leaving or being driven off the farms	20
10. Prejudiced against the larger farmers	17
11. Need more research	16
12. Antilabor bias	16
13. Farmers prefer to retain their way of life	15
14. An attempt should be made to find new markets for farm products	14
15. Agricultural fundamentalism	12
16. The family farm is necessary to the American way of life	11
17. The need for technical advice for farmers	11

In codifying the above information certain related attitudes and beliefs were combined into similar categories, some of which require further comment. Responses classified under the cost-price squeeze generally had reference to the upward trend in prices of nonfarm products and the downward trend of farm products. The second strongest response, that "the reduction in acreage allotment is very harmful to farmers' income," was often accompanied by the observation that such acreage reduction was actually pushing many small farmers off the farm and a fear of what would happen under future acreage allotment reduction (as yields per acre rise). The feeling that there was a strong (drastic according to some witnesses) need for more and better credit dealt with many specific issues—a need for long-term and low-interest loans on machinery, land, and housing; 100% housing mortgage insurance; more lenient terms to younger farmers; abolition of the 10% down payment on some loans; and loans for part-time farmers (who cannot get loans from the Farmers Home Administration even though they were originally farmers who were forced to take part-time city jobs). It was brought out that the FHA formerly could make housing loans but its authority to do so expired on June 30, 1954. Several specific recommendations were made to renew this

turns in an attempt to achieve exactness in the recording of responses. The above compilations, therefore, must be considered as reflecting the strength of different responses quite accurately but not necessarily without slight errors in tallies. One has only to briefly examine the hearings to see how the technique of conducting the hearings presented problems in codifying.

authority and to expand the FHA to meet many of these other credit needs.

With reference to the continuation of minimum price supports, many farmers advocated rigid supports at 90% and 100% of parity. They further felt that this was the only way for a farmer to get a fair return on his investment, and that this price protection (along with minimum acreage allotment) was analogous to minimum-wage legislation for labor. Many of the witnesses who recommended a system of minimum acreage allotments suggested that 10 and in several cases 5 acres would be sufficient.

The desire for additional governmental expenditure on research took the form of a demand for the development of new uses for cotton and other farm products, higher yields per acre, better soil use, and more effective marketing techniques. The antilabor bias, while present but not too strong, generally maintained that increased labor costs were the cause of prices of goods farmers buy going up and that the farmer was the one who unfairly had to pay for the additional labor costs.

There were innumerable responses that did not receive extensive individual support from the witnesses but that are worthy of mention here. There were suggestions, for instance, that allotments should be based on yields rather than acreage, that more money should be spent on forest development, attention should be given to industrial development, allotments should be more freely given to hardship cases, and allotments should not be given to people (especially doctors, lawyers, merchants and bankers) who do not earn their livelihood from farming.[19] Many farmers freely praised the usefulness of various USDA programs (extension, REA, soil conservation, Smith-Doxey Classifying Service, the home and county agents program) and the TVA. Some witnesses were quite concerned over the number of tenants who were being forced off the farms because of acreage allotment reductions,[20] and the failure of those who did not use their allotments to turn them in so that some one else could use them; others were of the opinion that high prices and high costs were drying up farm capital, and one dwelled on the idea that the government should not support a non-economical farm unit.

There were also some rather amusing solutions to the small-family-farm problem set forth, such as this statement reflecting upon the morals of small farmers on the one hand and appealing to the Almighty on the other: "I hear everybody putting up a hungry mouth. I think what these people need is to pray some more and live right."[21] Or this proposed

[19] In one county in Texas it was reported that 20 of the 23 farms over 2,000 acres were owned by people in these occupational groups. *Family Size Farms*, p. 84.

[20] The USDA estimated that 55,000 tenant farmers were "put on the road" this past year. *Ibid.*, p. 15.

[21] *Ibid.*, p. 201.

solution: "above everything else, these farmers need encouragement and kindness."[22]

Evaluation of the Committee Hearings and the First Interim Report

In the *First Interim Report* of the subcommittee considerable time is spent praising the family farm for its contributions to many so-called American values. In fact in some instances the committee apparently feels that the family farm is the sole source of these values.[23] This emphasis on the importance of the family farm to the "American heritage" is no doubt an attempt to rationalize the social and economic perpetuation of the family farm. (This is also an avowed purpose of the subcommittee.) The claims made, however, are not in proportion to the emphasis placed on this importance of the family farm by the farmers themselves in the hearings, and are furthermore open to some question as to their validity.

Many of the claims of the subcommittee center around the importance of the family farm to our free enterprise system and our political freedoms. The subcommittee gives the family farm credit, for instance, for having "established the economic foundation for the liberties and the enterprise, and the national conscience, that are the heritage of the United States."[24] Such a forceful statement fails to recognize the fact that a strong case has been made arguing that many of our democratic practices were developed not on the frontier or on the family farm in the South or the West, but in the urban areas of the East.[25] The subcommittee was further pursuaded by its studies that "beyond all other notice and regard, the agricultural order in the family unit must be considered especially for the spiritual, social, and political vitality it has contributed to our civilization."[25a] Just how does one go about measuring the contribution of various social groups or social organizations to the realization and perpetuation of these values? Again with reference to political values, the subcommittee has completely ignored the contributions of other groups in our society. As for the argument that the family farm is an indispensable agent in the development or perpetuation of the democratic form of government, which the subcommittee does not state in so many words but which it most certainly hints at in statements relative to political values (as in the above quotations), it has been pointed out (1) that in areas where there are small family farms democratic government does not necessarily prevail and (2) that in some areas just the contrary has occurred. In England, for example, democracy has devel-

[22] *Ibid.*, p. 364.
[23] See quotations below.
[24] *First Interim Report*, p. 1.
[25] Cf. Arthur M. Schlesinger, Jr., *The Age of Jackson*, Boston: Little, Brown and Company, 1946.
[25a] *First Interim Report*, p. 3.

oped in spite of a predominantly urban form of social-economic organization and in spite of a paucity of small family farms.[26] It would seem that there are other factors of transcending importance that influence or determine the development of democracies. Even if we assume the family farm has and still does contribute to the realization of such values, it too, in its present social setting in many areas of the country, has many disadvantages that contradict other of our social values—extremely poor educational and health services, and very low incomes and standards of living.

Considerable concern was expressed over the "number of farm families leaving the soil because of the deterioration of their competitive position. . . ."[26a] Since the subcommittee consistently praised the free enterprise system one must assume that they did so because of the assumed advantages such an economic system has to offer the members of society. The free enterprise system means competition and one of the advantages of competition is the lowest possible price to the consumer due to the inability of any single producer or any group of producers to control supply and therefore price, the elimination of the high-cost inefficient producers, and the introduction of technological improvements. With reference to the family farm we have here a situation in which this particular economic unit is being driven out of production, not so much because of concentration of production, but because it cannot compete cost-wise or machine-wise. We have here then not the *deterioration* of the competitive system but rather the *realization* of the competitive system. In addition, the most efficient size of the family farm unit has increased, but the capital, land, etc., of the family farm has not increased accordingly. How does one resolve this conflict between economic and other values to which the subcommittee really has reference, especially when the subcommittee stresses one economic value against itself—the advocacy of the competitive system because of certain social advantages it offers versus certain unwanted consequences of the competitive system.

According to the *First Interim Report* "the free enterprise system grew out of an early dream of a nation sustained chiefly by and for devout, free, independent, and home-owning farmers."[27] Another tenet of the free enterprise philosophy involves an emphasis on individualism and the absence of state intervention. Quite to the contrary, the subcommittee wants the state to intervene to perpetuate the free enterprise system—a system in which there is supposed to be an absence or a bare minimum

---

[26] A. Whitney Griswold, *Farming and Democracy*, New Haven: Yale University Press, 1952.

[26a] *First Interim Report*, p. 1.

[27] *Ibid.*, p. 1.

of state intervention. Actually, the state has historically supported and enforced even the free enterprise system. In reality the subcommittee is demanding nothing more than other groups in the economy demand, but this does reflect another basic conflict in our value system. In fact if we were to reorganize our economy along the lines of pure competition we would have a break up a very large share of our industrial firms. This does not appear to be impending. We want, in other words, part of the free enterprise system but not all of it. Or, many of us prefer free enterprise not in its totality but only "for ourselves."

Along this same line is the statement that "the testimony of farmers and the association with them disclosed an area in the national economy where free enterprise is suppressed. . . ."[28] As already indicated, there has been a substantial movement away from the competitive model in most areas of our economy. In fact, in agriculture, excepting government aid, we actually have more competition than in most other areas of the economy contrary to the subcommittee's contention that here it has been suppressed. Moreover, competition is not suppressed but is actually operating in this area of the economy as its advocates claimed it would, in terms of driving out the high-cost, inefficient producers, etc.[29] If we want to change the way in which free enterprise is theoretically supposed to work, or if we want to change our definition of it (as the subcommittee and others apparently have done) then this is something entirely different, as indicated above.

The subcommittee maintains that it is appropriate "to stress that the free enterprise system, in the natural aspirations for individual achievement by a free people, has two prime motivations. They are: (1) profit . . . and (2) the hope of people working for others, particularly those of younger ages, that with diligence and frugality some day they may own their own farms or their own business. This is an aspect of every man's desire to be his own boss."[30] Is not this a somewhat naive statement in view of the magnitude of the capital investment that is currently required to profitably enter into agriculture—or many other areas of business for that matter; and in view of the actual lack of mobility (compared with the popular ideologies) in industry today insofar as a great many of the higher executive positions are concerned.[31] Furthermore, the

[28] *Ibid.*, p. 10.

[29] See the previous paragraph.

[30] *First Interim Report*, p. 3.

[31] Cf. *Fortune*, November, 1952, p. 135. The general thesis of this article is that the captains of industry are no longer being replaced by the office boys working their way up from the bottom rungs of the occupational ladder, but rather are being replaced by their sons or other professional executives. See also W. L. Warner and J. C. Abegglen, *Occupational Mobility in American Business and Industry*. Minneapolis: University of Minnesota Press, 1955, pp. 45, 95.

contention that every man desires to be his own boss is also open to controversy. Some do not want this responsibility and others have long reconciled themselves to the fact that for all intents and purposes to own their own businesses is quite out of the realm of the possible.

Quite misleading is another statement maintaining that "Free enterprise is the spirit of the frontier. The frontier must be kept open for men to venture into, and to achieve independence in individual and family enterprises."[32] In the particular context in which their statement is made the authors appear to have reference to the maintenance of opportunities for small farmers (and small businessmen) to exist; however, as it is stated there seems to be an allusion to a land frontier. If the latter interpretation is accurate then it should be noted that there is an estimated potential net addition to our cropland of 245 million acres,[33] but to whom and under what conditions is this land available to family farmers? Much of it already is in the hands of farm owners themselves. On the other hand, if the committee has in mind individual business ownership or the attainment of executive positions, then the comments relative to mobility and capital investment in the preceding paragraph apply here too. Furthermore, the inference that free enterprise is solely a frontier phenomena again ignores the role of city or small-town people in this development.[34]

As a last criticism of the subcommittee's *First Interim Report* let us examine the following paragraph:

> Thus exposed to the unrestrained play of economic forces, agriculture in the late 1920's was caught in a downward spiral of prices. Then, much as today, there was prosperity in the rest of the economy. . . . But, when the whole economy entered into the great depression, the Nation became aware of the importance of agriculture to the well-being of all our people.[35]

This statement is subject to criticism on two grounds—its hints at "agricultural fundamentalism" and its consequent implied slighting of the importance of other factors as causes of the depression of the 1930's. This is perhaps a reflection of the statements of some witnesses in attendance at the hearing or of the thinking of the subcommittee members themselves, or both. Agricultural fundamentalism contends that agriculture is the foundation of the American business structure and that therefore farming is the most significant element in our economy—as the farmer goes, so goes the rest of the economy. It is one thing to argue that

[32] *First Interim Report*, p. 3.

[33] John D. Black, "Agriculture in the Nation's Economy," *American Economic Review*, XLVI (March, 1956), pp. 9-10, quoting from the President's Materials Policy Commission.

[34] See p. 1005, above.

[35] *First Interim Report*, p. 7.

farming is an important sector in our economy but quite another thing to argue that it is a determining or causal factor in the level of economic activity. One can grant that fluctuations in farm income have repercussions in other areas of the economy without accepting that farm income determines the state of the economy. Furthermore it is a bare fact that agriculture in the United States (and in many other countries) is a "declining industry"—it takes fewer and fewer people to produce more and more farm products notwithstanding an expanding population, full employment and high incomes in other areas of the economy.[36] Within this particular context it is significant to point out the per cent of population, labor force, productive assets, national income, gross national product, and net national product engaged in or going to agriculture, especially on a comparative basis:[37]

	Population	Labor Force	Productive Assets	National Income	GNP	NNP
1910	34.7	31.1	42.3	14.1	16.1	18.0
1954	13.5	10.1	23.0	5.3	5.9	5.0

In addition to the rather extensive discussion of the relationship between values and the family farm the *First Interim Report* of the subcommittee also reflected to a considerable degree the attitudes and desires of the witnesses who participated in the hearings. (Although the emphasis that the *First Interim Report* placed on the social, political and economic value of the family farm was a reflection of the attitudes[38] brought out in the hearings, such emphasis was entirely out of proportion to the importance attached to these values by the farmers themselves.) The report actually discussed or at least supported with a short statement all but three of the seventeen witness responses cited above. The following responses were expressed in the *First Interim Report:* "the acreage allotment reduction is very harmful to small farmers' income," "concerned over the cost-price squeeze," "minimum price supports should be continued," "small farmers need more and better credit," "there should be minimum acreage allotments for small family farms," "the farmer deserves his fair share of the national income and a decent standard of living," "concerned over the number of people leaving or being forced off the farms," "more money should be spent for conserva-

[36] The interested reader should examine Joseph S. Davis, "Agricultural Fundamentalism." *Economics, Sociology and the Modern World,* ed. by Norman S. Hines. Cambridge, Massachusetts: Harvard University Press, 1935; and Theodore W. Schultz, *Production and Welfare of Agriculture.* New York: Macmillan Co., 1949, p. 105.

[37] Black, *op. cit.*, p. 24.

[38] The responses of the witnesses in the hearings somewhat related to the discussion of values in the subcommittee report were "agricultural fundamentalism" and "the family farm is necessary to the American way of life."

tion and soil building," "favored the continuation of acreage control,"[39] and "an attempt should be made to find new markets for farm products." A further response was brought out in the minority report of the subcommittee—"the need for technical advice for farmers," and another was indicated but not stated quite so strongly as by the witnesses—"prejudice against the larger farmers."[40] To this extent, then, the *First Interim Report* was a quite accurate reflection of the sympathies and attitudes of the witnesses who participated in the hearings. The witness responses that the writer did not find reflected in the subcommittee report were as follows: "an antilabor bias," "the need for more research," and "farmers prefer to retain their way of life."

Since the subcommittee felt that credit was so important to family farms it included in its report an appendix explaining the types and amounts of credit available to operators of family farms through the Farmers Home Administration. Incorporated into this discussion was an analysis of the Bankhead-Jones Farm Tenant Act, the Water Facilities Act, Public Laws 38 and 727 (as amended), and Title V of the Housing Act of 1939.

The subcommittee concluded that the greatest need of the family farmers is an adequate farm with suitable equipment. Although the report included many worthwhile recommendations that were entirely in line with the findings of the above analysis of the hearings,[41] there was no real attempt to develop a comprehensive program of a long-run nature to get at the basic problems.

Administration of the Hearings

The following points were noted in reference to the manner and areas in which the hearings were held: (1) Four[41a] of the seven places in which the hearings were held were also the congressional districts of certain of the subcommittee members. And in all these places the Representative took over the Chairmanship after a laudatory introduction by the subcommittee chairman. One might well ask what relationship these facts bear to the forthcoming congressional elections. (2) Certain people were excluded from the hearings. At one point the subcommittee chairman refused time to representatives of the CIO and the AFL.[42] Another time a

[39] The subcommittee apparently assumed that acreage allotments would be continued. See *First Interim Report*, pp. 22-23.

[40] Cf. *Ibid.*, p. 24.

[41] See *First Interim Report*, pp. 19-24, and the discussion of parity, minimum acreage allotments, payments to farmers, credit, markets, industry, conservation and the need for leadership.

[41a] Two of the remaining three subcommittee stops were at educational institutions and only academic personnel testified.

[42] *Family-Size Farms*, p. 101.

farmer filed a written statement charging that "It is quite evident that the local powers that be stacked the witnesses at this hearing. I trust that this is not always the case. It is also evident that for some reason, perhaps political, perhaps for my own well-being, I was not allowed to testify orally because I clearly disagreed with the arguments being given."[43] Such instances of excluding potential witnesses may not have been generally practiced, although no conclusive evidence bearing on this point was revealed. Much can be said, however, for bringing in outside witnesses who may be able to make real contributions to such a formidable and immense problem as the one with which this subcommittee is dealing.

Inasmuch as there was some indication that political considerations may have entered into the operation of the hearings, the author wrote to the subcommittee chairman requesting information concerning why certain areas were selected as cites for the hearings, the basis of selecting witnesses, how the witnesses were notified, whether or not they were instructed to come prepared to discuss certain topics or were given a free rein, and whether or not the hearings were open to all interested persons. In response to the first query the chairman responded that "The hearings started in the small farm section of my Congressional District for at least one obvious reason—namely, that I was better aware of it than I was of the farm problem in other areas. We had to start somewhere and it seemed to me as Committee Chairman, I would be entirely in order if I set the pattern among the people I knew the best." Two other areas were selected by the chairman because he "was particularly anxious to secure the active interest of" two other committee members.[43a] Other sections of the country so affected by the small-farm problem were passed by because they are being handled by subcommittees dealing with specific crops—dairy products, poultry and eggs, soy beans and oil seeds, etc. There was, however, no effort to get any over-all sampling of the small farmers and their problems. As for the witnesses, they were reportedly "selected under the direction of the Members of Congress involved. Methods varied somewhat but in general they were assigned topics . . . and encouraged . . . to speak freely about anything that may have been on their minds." It was further maintained that the subcommittee "avoided organizations, including farm organizations, on the grounds that they are represented in Washington and can testify before us at any time." But this does not explain why, in view of the above

[43] *Ibid.*, p. 103.

[43a] It would seem that as congressmen and as appointed members of such a small subcommittee they would have an obligation to "be interested" and that "special encouragement" should not have been necessary.

analysis of witnesses, which lists some nineteen witnesses as representing farm associations (particularly the Farm Bureau), the CIO and AFL were excluded.

Concluding Statement

Although much of our agricultural policy has been aimed at preserving the family farm it is to be noted that in many ways congressional and USDA policies have hurt the family farms. Diversification, which several agricultural agencies have been pushing quite vigorously for some years, is not always the answer. In some cases farmers just do not have the markets for the crops. In other cases farmers have spent considerable sums of money transferring to other areas of production only to find that there have been serious drops in the prices of these products. Furthermore, quotas come along and the farmers who voluntarily reduced acreage cannot even go back to their original crops. No doubt much of the research of the state and federal agricultural agencies, and the impetus supplied by guaranteed price supports, has resulted in increased yields, surpluses and lower prices. And in many cases the small farmers have not benefited proportionally in the increased yields; nor can they compete mechanically with the larger farmers. Furthermore, the increased yields on the part of the larger farmers have no doubt contributed to overproduction, acreage allotments, and therefore cuts in the small farmers' acreage. A flat 10 or 15% cut to all really hurts the small farmer. There is no intention to place a value judgment upon these practices, but the purpose here is merely to point out some of their effects.

At this point one may well ask if the family farm should be preserved, especially in view of the increase in the optimum size of the family farm, the increase in capital requirements, and certain limitations of the family farm itself that result in serious social and economic costs to society.[44] Insofar as values are concerned there is no conclusive evidence that the family farm has been as important as many assume in the evolution of the so-called American values of a "spiritual, political, and economic nature." Nor is it beyond question that agriculture is the determining factor in our level of economic activity. It must be granted that legislation has objectives other than those of a strictly economic nature; however, it is not to be so readily granted that the family farm is the only medium through which these goals can be achieved (even assuming the relationships exist).

All this does not mean that the family farm should not and can not be preserved. The opinion of this writer, however, is that it is more logi-

[44] For a discussion of disadvantages of the family farm see Halcrow, *op. cit.*, pp. 196-97.

cal to help these people on the basis of attempting to solve a socio-economic problem[45] rather than on the basis of an emotional attachment to values attributed to the family farm in the face of questionable evidence. Furthermore, one of the greatest fallacies of our thinking (and of some of our policies) has been to assume that we can and should preserve the family farm in its present form. To attempt to do this would be not only ridiculous and impractical but quite unfair to the farmers themselves. We would merely be perpetuating their lowly economic circumstances. A farmer with a small amount of land and without great capital investment or farm skills could adequately support a family at one time, but this is no longer true.

It is not necessary to repeat at this point the multitudinous problems, or the relative magnitude of the problems, that confront the smaller family farmers. Their over-all problem is primarily one of deficient farm size, inadequate credit facilities, insufficient buildings and equipment, scanty industrialization, inferior educational backgrounds, and lack of technical skills and managerial know-how—all of which result in low incomes for these people. The need for easier and cheaper credit as a means to expand farm size, purchase buildings, equipment and homes is serious, especially for the younger men wishing to go into farming. Several studies have indicated the inability of certain individuals and groups to get loans, and also the fact that in many areas in the South interest rates are drastically higher than those for other areas of the country.[46] Industrialization helps these people in that it offers them alternative employment, which will in all probability also provide them with a higher standard of living. In addition, to the extent that people leave the farms, the per capita income of each unit rises because the total income is now divided among fewer people. Also, industrialization tends to bring about an increased demand for certain farm crops. Education serves obvious values particularly since today a farmer almost has to be a technician. There is a need for vocational education not only for the farm[47] but also for preparation for non-farm employment (which could be provided by high schools, federally sponsored agencies, or by industry with on-the-job training).

At best the subcommittee recommendation relative to these and other

[45] This reflects a value judgment, too.

[46] U. S. Congress, House, *Study of Agricultural and Economic Problems of the Cotton Belt,* Hearings before a Special Subcommittee on Cotton of the Committee on Agriculture. 80th Cong., 1st Sess., Washington: Government Printing Office, 1947, pp. 584-587, 588, 558f.

[47] A sample survey of farm operators of cotton farms in the Piedmont of South Carolina and Georgia showed that only 8% had any agricultural training. John L. Fulmer, *Agricultural Progress in the Cotton Belt Since 1920,* Chapel Hill: University of North Carolina Press, 1950, p. 183.

problems in only a palliative, not a cure. In the opinion of this writer what is needed most of all is a program such as that proposed by the USDA in its "Conversion Program for the Cotton South."[48] Here is an admirable attempt through a comprehensive master plan operative on an individual farm basis designed to move farmers so desiring off the farms (with an effective procedure for training and placement, expanding the farm size for those who remain, providing the proper training in farm management, and the required capital).[49] No doubt this plan has certain problems to overcome—are there enough jobs in industry to support these people? What about the inertia of certain farmers? Do many of these people really want to move in view of the difficulties involved in establishing new social relationships? Nevertheless, it still is one of the best and most comprehensive solutions yet put forth to get at the basic problems.[50]

[48] Cited in "Adjustments in Southern Agriculture with Special Reference to Cotton," *Journal of Farm Economics*, XXVIII (February, 1946), p. 376.

[49] Others have offered solutions that are worthy of examination to the interested reader. Fulmer, *op. cit.*; D. Gale Johnson, "Coming Developments in Agricultural Policy," *Journal of Farm Economics*, XXXIV (December, 1952), pp. 616-624; Charles Sayre, "Dynamics of Farm Adjustments in the South," *Journal of Farm Economics*, XXXII (November, 1950), pp. 721-734.

[50] Space and purpose do not permit an extensive discussion of some of the preferred solutions such as those presently cited.

OUTCOME OF LAND REFORM IN THE REPUBLIC OF KOREA*

KI HYUK PAK**

Introduction

SINCE World War II, Korea, no less than many other small nations, particularly in Asia, has undergone rapid and revolutionary change in economic, political, and social structure. In Korea, as in most of these nations, the most generally significant and popular measure has been "land reform."

When the Republic of Korea enacted the Land Reform Law in 1950, it set in motion a most important series of changes in the economy of South Korea. The purpose of land reform was set forth in Article I as follows: ". . . on the basis of the Constitution of the Republic of Korea pertaining to farm lands to improve the living conditions of farmers, to keep the balance of, and to develop the national economy by *increasing agricultural productivity.*[1]

Maximum size of farm set by the law was three chungbo (7.35 acres).[2] The terms of the Republic of Korea land reform program were such that a tenant purchaser was sold the land at 150 per cent of the total value of one year's crop. The tenant purchaser was allowed to pay 30 per cent of the crop for five years. The land lord was given bonds limited in redemption in any one year to 30 per cent of the value of the crop estimated as an average harvest and he was allowed this 30 per cent of crops over a five-year period.

In South Korea about 70 per cent of all farmers were tenant farmers in 1945. The rent paid peasants ran as high as 60 per cent of the crop. This went largely to absentee landlords, who made up a small but wealthy aristocracy.

One of the basic difficulties faced in land reform in Korea was the fact that it was conducted during a war period when there was extreme inflation. The accumulated price increase from mid-1945 to mid-1953 was on the order of a ten thousand-fold jump.[3]

---

* For further discussion see the writer's Ph.D. dissertation, University of Illinois, "Economic Analysis of Land Reform in the Republic of Korea, with Special Reference to an Agricultural Economic Survey, 1954-55."

** The American Korean Foundation, New York City, provided the writer unusual opportunities for a field study in his homeland during 1954-55. This work was accomplished under the general supervision of Dr. C. L. Stewart, University of Illinois.

[1] Italics supplied by the writer.

[2] One chungbo is 2.45 acres.

[3] Robert R. Nathan, *An Economic Programme for Korean Reconstruction*, prepared for the United Nations Reconstruction Agency, Washington, D.C., 1954, p. 44.

Expected redistribution of land was planned to affect about 40 per cent of the total arable land in South Korea, including both vested land[4] (232,832 chungbo) and the area subject to tenure reform. Although only about 69 per cent of the total area of 833,000 chungbo has actually been redistributed (577,000 chungbo), 50 per cent of the total farm households were affected.[5]

Impacts of Land Reform

To test the effect of land reform the writer set four steps of analysis: (1) agricultural productivity, (2) marketing of farm products, (3) land taxation, and (4) merits and demerits of land reform.

(1) Agricultural productivity

In terms of the four factors of production what indications are there as to how productivity of land in future may be effected by the land reform?

a. Land

According to the statistical report made by the Korean Reconstruction Bank the number of small farms (less than 1.22 acres) increased almost 3 per cent from 1947 to 1953. Our study of 360 farm households[6] showed changes in their size of farm between 1950 and 1955 as follows: moderately large farms (more than 2.45 acres) had increased up to three per cent, medium farms (between 1.23 and 2.45 acres) had decreased four per cent, and small farms (less than 1.22 acres) had decreased seven per cent.

Land reform appears to have resulted in relatively small changes in farm size and to have made only limited progress in its objective of consolidating land holdings.

b. Labor

During the Korean War there was widespread displacement of farm families from their villages. According to the Year Book of Agriculture and Forestry Statistics, 1953, 10 per cent of the total farm people had removed from their farm as compared with prewar. The Department of Economic Research at the Rehabilitation Bank of Korea estimated that the total national population increased eight per cent above the prewar level by 1955. The writer has estimated the productive work units among 360 farm families in the survey area in South Korea by use of standard

[4] Vested lands were formerly owned by Japanese.

[5] One chungbo is converted into 2.45 acres.

[6] The field survey covered 360 farm households in 20 villages in five agricultural provinces in South Korea. Those households and villages were selected which had the greatest amount of land distributed among them.

based on working ability.[7] An indication of change in productive work units was found in the survey between the prewar, wartime, and postwar periods. Despite the fact that the war caused approximately one million casualties, Korean population has continued to grow rapidly beyond the prewar level. It is not true, however, that productive work units during the war period increased over all Korea. The decrease of essential working power in the surveyed area during the war was 12 per cent and in 1955 working power was still about five per cent less than the prewar level. Although the number of workers has increased, the net strength in productive units has declined.

c. Capital

Through land reform the tenant purchaser in Korea became independent farm operators, and consequently, the responsibility of providing operating capital fell upon them. Formerly they obtained their operating capital from landlords. After the land reform, their former sources of financing were lost. Obtaining adequate farm credit became an acute problem for farmers. The establishment of new sources of farm credit became a most important problem of the land reform.

Although farms larger than medium size could get some operating capital from local financial associations, small farmers generally were not able to get operating loans. This was because the risk to credit institutions was too great when lending money to owners of small farms. Agricultural cooperatives were not organized, and tenant purchasers were not supplied adequate operating capital. Cooperative credit organizations have not had adequate legal protection and have not been active in rural communities in Korea. According to our survey, not one of the farmers in 360 farm households had joined an agricultural cooperative organization. According to the Land Reform Law (Chapter 4, Item 16), distributed land should not be mortgaged or sold until the endorsement payment was completed. Thus small tenant purchasers who represented 45 per cent of the total farm operators did not have a real estate credit base for borrowing operating capital. Consequently, they had to obtain loans from private sources at high interest rates. Although the government management loans have become a hot political issue in Korea, money from this management fund has generally not reached the small

[7] The classification of working ability was applied by a standard table which was and has been used for some time by the Suwon Central Agricultural Experiment Station in Korea. The standard table for working ability is derived as follows: Full working power (1.0) applies to male workers in the age groups between 18-54 and full working power (0.8) for females between 17-44. Males between the ages of 16-18 and 55-59 are also included in the 0.8 classification. The rest of the age groups are considered as less than 0.6 in comparative productive power.

farmers. In those families in Chulla Pukto, one of the survey areas, it amounted to only 600 hwan ($1.20) per family unit. Thus it is obvious that farmers were not receiving adequate operating capital from the government. The small farmers in the survey areas could lay little claim to efficient farm management, and in many cases their lands were sold in the black market. Former tenant farmers, after a period as tenant purchasers thus were becoming tenant farmers again. Lack of an adequate credit institution could be classified, therefore, as a major deficiency in government policy after the land reform.

d. Management

Efficient agricultural production requires coordinated management of land, labor, and capital. With the basic handicap of small farmers in rural Korea evidenced in the shortage of available operating capital, management of farms is rendered difficult. Perhaps the most critical problem in the Korean rural economy at the present time is the shrinkage of working capital to a point making it impossible for many farmers to maintain ownership or successful operation of their farms.

Among 360 farm households included in our survey interviews, not one had been reached by the extension service. According to our survey in Chulla Namdo, annual rice yield per *tanbo*[8] in well-irrigated and better-managed paddies in 1955 was 6.8 *sok*,[9] which is more than five times the present national average yield of 1.3 *sok*. Therefore, if an effort were made to increase productivity per acre by improved techniques by even as little as 50 per cent of the 6.8 *sok* per *tanbo* level, then the family operating a farm of smaller size would at least maintain a subsistence level of living. In the case assumed, 1.22 acres of farm land could produce as much as 17 *sok* per year. Of this 7 *sok* are necessary for family consumption. Farmers could then sell 10 *sok* on the market. Although so high a yield may not be attainable in all parts of South Korea, the overall national production could have a substantial increase. A first objective of farm management is an increase of output by which the standard of living of the mass of farmers would be substantially improved.

(2) Marketing of farm products

The cultivation of rice and grain occupies more than two-thirds of the total farm land in Korea and 97 per cent of Korean farmers are producers of rice and other grain. Rice marketing, of course, has key importance in agricultural marketing in Korea.

In reality there have been two market systems in Korea: the govern-

[8] One *tanbo* is converted into 0.245 acres.
[9] One *sok* is 4.95 bushels.

ment-controlled market and the free market. The Korean government controls the rice market and receives crops in settlement of land purchase installments and land taxes. In addition to this, the Korean government purchases crops from the farmers totaling up to one-third of the entire national rice production every year, in order to supply food for armed service personnel, government workers, and for preparedness against emergency (spring famine or war). The Korean government passed on February 20, 1950, its Law No. 349 for crop control.

Although rice merchants normally had a prosperous enterprise in Korea, many of the larger rice merchants were bankrupted during 1953. This was mainly because of government importation of foreign crops, and consequently, many small retailers took to bringing rice from local regions to the towns and cities. The small retailers have thus been filling the gap left between the government distribution system and the traditional market system in Korea. This means, among other things, that there has been no hedging or futures exchange market in Korea up to now.

The Korean government applies a two-price system in rice collection and government redistribution. When the government distributes the collected rice, it charges prices approximately 30 per cent higher than the original price paid to the farmers. These prices are still approximately 30 per cent lower than the free market price.

Table 1 shows the extent to which the volume of products marketed, as between different farm sizes, has been dependent upon total output. Small farmers used 62 per cent of their total rice production in order to support their families. In addition to this, the small farmers paid 28 per cent of their total rice production to the government in the form of land purchase installments and taxes. Small farmers thus had only 10 per cent of their total income with which to pay debts and meet other expenses. Obviously, the small farmers in such circumstances could not have much rice to sell in the market. Small farms, therefore, are not to be classified as commercial enterprises, being used by the farmers for self-sustenance. It is the medium and large farms that have been supplying nearly all of the food for the urban people. Households of these latter classes of farmers consumed as food 37 per cent and 24 per cent, respectively, of their rice production. By law the moderately large and medium farmers were obliged to sell to the government up to 24 per cent and 22 per cent, respectively, of their total production of rice. They were deprived to this extent of the free marketing of their rice, although they tended, where practicable, to hold back some rice for the better price they could expect to get on the free market. The moderately large farmers kept 25 per cent, and the medium farmers 13 per cent of their total rice production. Thus

it appears that the law hit the small farmer especially hard, for he had for sale no more than 10 per cent of his crop. Since he has been obliged to sell so largely to the government, he has had little opportunity to get the more advantageous price in the free market.

In practical terms the small farmer has been unable to sell more than 7 per cent of the nation's total rice production. Set back by the inadequate system for marketing his products and his lack of knowledge of financing, the small farmer sold little in the market. Household requirements, too, were such that most of his rice at home was consumed.

TABLE 1. APPORTIONMENT OF PRODUCTS TO LAND PAYMENTS, TO LAND TAX, TO SEED USE AND TO HUMAN CONSUMPTION, IN FIVE PROVINCES, SOUTH KOREA (360 FARM FAMILIES) 1954

Size of farm	Name of crop	Ratio to total products (100)						
		Land tax	Sold	Food	Seed	Feed	Land payment	Excess or shortage
Moderately large (120) households)	rice	10	24	24	1.0	—	15	+25
	grain	9	13	64	5.5	—	11	− 3
Medium (120 households)	rice	7	22	37	2.3	—	19	+13
	grain	9	8	52	5.4	—	15	+11
Small (120 households)	rice	6	10	62	2.7	—	22	− 3
	grain	10	10	98	6.2	—	19	−43

The plus and minus signs refer to excess and shortage of food production. For further details see Table 18, in the writer's thesis, page 112a.

(3) Land taxation

Because the war destroyed almost all industrial property, the Korean government passed a law imposing a comprehensive tax on land. Enacted as an emergency measure, this levy is still in effect. Despite the consolidation of central government levies into a unified tax, local governments have continued to lay various imposts upon farms. These levies, national and local, represent a considerable reduction in the net income of farmers. The Tentative Land Income Tax Law of September 25, 1951, has been the occasion for concern among Korean farmers, especially regarding the future. Farmers have been expressing fear that this single-package tax may be increased after their land-acquisition payments are completed. Their concern seems to be that effort may be made to maintain the current level of government income in land-acquisition payments and taxes combined, a result that might bear an uncomfortably

close resemblance, in its total weight, to the high level of rent charges faced prior to land reform.

(4) Merits and demerits of land reform

Although land reform in Korea has lacked much of being entirely successful as an economic policy, it has brought significant changes in rural life. Compared with a decade ago, the Korean farmer's status has been entirely changed. Centuries-old feudalistic landlordism has been destroyed and many farmers are, for the first time, enjoying the freedom of democracy and rights of ownership in rural areas. The size of farm has increased moderately from what it was during the Japanese occupation, and the standard of living has improved. Because of many factors beyond man's control, and because of inadequate government protection after the land reform, tenant purchasers have had to meet the heaviest of economic and political challenges by themselves. Small farmers have declined in economic strength from the time of the land reform in 1950. Farms having larger than "moderately large" incomes have steadily increased and enlarged their holdings and the owners of these farms have also leased out some of their land.

The most significant result achieved by land reform during the war was the allaying of social and political unrest. In fact land reform saved human lives, particularly for landlords because there could have been serious rioting against landlords by landless peasants.[10]

The majority of the landlords dispossessed in Korea in the early 1950's went bankrupt. For 84.2 per cent of the total landlords had only small land holdings and had been receiving not to exceed 50 *sok* in annual rent. Since land payments were spread over a five-year period, the amount received each year was so small that little industrial capitalization could be stimulated through these former landlords.[11] A landlord could barely support his family with proceeds of land sale to former tenants.

Conclusion and Suggestions for Future Improvement

Experience seems to the writer to have shown that the concept of land reform must be broadened from the traditional principle of "land to the tiller" to include the economic reconstruction of the whole agrarian system. In particular, the small farmer should be aided to become economically productive. Much of the work is of a type to be advanced

[10] Chin-kuk Kang, a former chief of the bureau of land administration at the Ministry of Agriculture and Forestry in the Republic of Korea, stated that land reform prevented fighting between peasants and landlords. Such conflicts could have killed people on each side, while the Korean War was in the balance.

[11] For a similar view, see "The Korean Reconstruction Bank," *Economic Review (1945-1955)*, Seoul, Korea, 1955, p. 60.

through government educational and extension services, including help in organizing farmer cooperatives for financing, producing, and marketing products. For example, there should be a comprehensive program for all of Korea to work toward equitable taxation and toward the conservation and improvement of the land resources through irrigation and reclamation projects.

Although all segments of the national economy need to be better developed, including the industrial segment, no one segment should be supported and expanded at the expense of another. Up to the present, at least, agriculture is the mainstay of the national economy in South Korea, and it is certain to continue to be of basic importance in the future. By means of a balanced and comprehensive economic program, based upon continuous empirical observation and study, it seems entirely possible to achieve for Korea a self-sufficient and stable economy within 10 to 15 years. The most important need is for exact information about the economic situation all the way from the most isolated local community to the most sophisticated urban center. After having been the cockpit in the great Asian struggles of the recent past, achieving a realization of the economic potentialities of the Republic of Korea will be a challenge of an even more constructive type.

The following areas seem important to the writer for improving the nation's agricultural economy.

a. Given sufficient financial support and technical management, production on farms of even the present uneconomic size could be doubled, by irrigation, seed improvement, proper fertilizing, double cropping, and the like.

b. Further fragmentation of holdings might be prevented by close government supervision and enforcement of the law.

c. Tests should be made to determine fertilizer requirements and to determine what crops might be grown on the unirrigated paddy land, which is approximately 40 per cent of the total agricultural land in South Korea. Commercial fruit and truck farming might be feasible on the uplands.

d. The land committees can be made more democratic by offering membership to tenant purchasers. The committees can, with helpfulness, keep close check at the farm level on tenant purchasers to discourage their sinking back into tenancy under contracts with nonfarmers.

e. Some means of supplying agricultural credit must be provided soon if the farmer is to be reasonably certain of this land, his livelihood, and the necessary fertilizer and other supplies for productive farming. At the very least, farmers should be enabled, through the enactment of cooperative association laws, to help themselves by community effort

directed to their common problems of credit, production, and marketing.

f. Some measures are needed to rationalize the use of labor. Steps are needed to provide productive employment for farm workers during the long periods between the two peaks of labor requirements, at planting and harvesting times. Light manufacturing or handicrafts, more intensive livestock raising and feeding, sericulture, and the like could be encouraged through a government program of information and education.

g. Farm incomes could be improved rather quickly by revising the government-fixed prices upward to actual market values and by prompt and adequate delivery of fertilizers.

h. The commercial and physical processes of marketing and distribution need to be greatly improved. There is no reliable and uniform system of gathering and disseminating market information. Transport and storage facilities should be improved.

i. The present system of charging heavy fees for local services and of soliciting so-called "voluntary" contributions for various semigovernmental purposes should be reformed.

j. The government should make and execute long-range plans carefully and consistantly. To begin with government itself, there is urgent need for higher salaries to prevent squeeze by or bribery of government officials.

k. Research activities should be organized and adequate research information on agricultural resources and potentialities should be provided on an improved basis for policy formation.

l. The government should develop a comprehensive program for agricultural education, including an extension service to guide farmers in applying the technical knowledge already available for improved production. It should stimulate agricultural colleges in each province to train teachers and leaders of the farm people in their struggle toward better understanding and better living.

m. Technical assistance as well as financial aid should be solicited from other countries. In the long run, borrowed know-how will be of greater real value than borrowed money or goods.

MIGRATION AND FACTOR ADJUSTMENT IN LOWER MISSISSIPPI VALLEY AGRICULTURE: 1940-50

FRANK T. BACHMURA*
Vanderbilt University

THIS paper, which is part of a larger study of Southern economic development,[1] concerns itself with adjustments during 1940-50 in the agricultural labor force and related production factors of a twenty-four county area[2] in the Lower Mississippi Valley.

After initially examining income differentials among the counties of the study area, the writer seeks to determine whether or not appropriate adjustments of production factors, including labor, took place within the area during the decade, and, in particular, whether these adjustments are applicable to the rural-farm residential sector. More specifically, the writer tests the following hypotheses:

(1) Population change has been selective as to (a) income, (b) race, (c) residential sector, and (d) local development in manufacturing industry.

(2) Agricultural production has become more (a) labor extensive, (b) land intensive with respect to labor and extensive with respect to capital, and (c) capital intensive with respect to land and to labor; and that (d) these movements have been "income corrective" with respect to county income differentials.

---

* The writer wishes to acknowledge the support of the Rockefeller Foundation in financing this study, as well as the constructive criticism and inspiration of William H. Nicholls, Anthony M. Tang, and other members of the Vanderbilt University economics staff.

[1] For the original prospectus to the over-all project see William H. Nicholls, "A Research Project on Southern Economic Development, with Particular Reference to Agriculture," *Economic Development and Cultural Change*, Vol. 1, No. 3 (Oct., 1952), pp. 190-95. Prior published progress reports are: Anthony M. Tang, "Farm Income Differentials in the Southern Piedmont, 1860-1940," *Southern Economic Journal*, Vol. XXIII, No. 1 (July 1956), and William H. Nicholls, "Some Foundations of Economic Development in the Upper East Tennessee Valley, 1850-1900," *Journal of Political Economy*, Vol. LXIV, Nos. 4 and 5 (Aug. and Oct. 1956).

[2] The study area, somewhat larger in land area than Massachusetts and Connecticut combined, produced 11 per cent of the nation's cotton in 1949. All of the counties (listed in order of size of median income in Table 1) lie within the valley of the lower Mississippi, and are drained either by the Mississippi itself or by a number of its minor tributaries. Eleven of the counties are in the Brown Loam soil province, namely, Benton, De Soto, Marshall, Panola, and Tate counties in Mississippi, and all of the Tennessee counties. The remaining thirteen counties are in the Delta soil province. In 1950, all of the counties were within the lowest fifth of U. S. counties according to the Farm-operator Family Level-of-living Index.

I. Selectivity of Population Adjustment

Income selectivity

The selectivity of migration and population change with respect to income is consistent with the equilibrating action of competitive factor markets in the absence of pronounced impediments to factor mobility. Thus, given geographically disparate rewards to presumably homogeneous (within each race) supplies of labor, one would expect in-movement to areas of higher income and out-movement from areas of lower income. We consider here that income rewards constitute an accurate index of rewards for labor services.

There are wide disparities in average income among the counties of the study area as evidenced by the data in Table 1, Column 2. Combination of the two racial groups tends to conceal income dispersion as measured by coefficients of quartile deviation[3] (C. Q. D.) shown in Table 1, since greater dispersion is shown for county incomes considered by race (Columns 4 and 5).

With the use of more refined data these disparities persist. Average county incomes per family and unrelated individuals of all races, estimated from class interval data, provide a series resulting in a slightly reduced coefficient of quartile deviation (0.146). The addition of the imputed value of farm home consumption to these averages still further reduced the coefficient (0.104).[4] The highly significant rank correlation (+.966**)[5] between the latter series (showing least dispersion) and the median income series would appear to justify the use of the median measure for subsequent analysis.

For testing the income selectivity of intercounty migration during 1940-50, we should like to have comparable income data for 1939. However, only 1949 data are available. Nonetheless, in considering an area within which geographical income disparity appears to persist (judging

---

[3] One advantage of using this measure of dispersion is that it is not unduly affected by a single large deviation. Particularly with respect to county income data, amounts for Shelby county (containing Memphis) would strongly influence results of a coefficient of variation, for instance.

[4] If, instead of using "families and unrelated individuals" as an income unit, one uses Census of Population enumeration of "labor force," which has the effect of eliminating the influence of family size, the result is a series with an increased rather than a decreased quartile deviation coefficient (0.119).

[5] Wherever used, this symbol (**) indicates a confidence coefficient of 99 per cent or more, which for $n = 24$ (the number of counties in the study area) means a rank correlation coefficient (*rho*) of at least .485. A single asterisk (*) indicates a confidence coefficient of more than 95 per cent but less than 99 per cent, which for $n = 24$ means rank correlation coefficients ranging from .343 to .485. All correlation coefficients shown herein are Spearman's rank correlation coefficients (*rho*), sometimes shown as (ρ) in the literature of statistics.

TABLE 1. COUNTY INCOME, POPULATION ADJUSTMENT, AND MANUFACTURING DATA

County		Median incomes, 1949[a]				Gross value of farm products per farm worker		Estimated migration rates, 1940–50[d]		Percentage change, rural-farm population, 1940–50[e]		Value added by manufacturing per capita[f]	
		All races		All sectors									
		All sectors	Rural farm	White	Nonwhite	1949[b]	1939[c]	White	Nonwhite	White	Nonwhite	1947	1939
Shelby	T[g]	$2,248	$1,094	$3,123	$1,315	$1,256	$562	+33.5	+ 3.2	−30.70	−26.91	$412	$160
Mississippi	A	1,317	1,037	2,010	826	2,916	700	−23.4	−35.4	−12.13	−30.15	74	19
Tipton	T	1,259	1,052	1,705	764	1,552	555	−22.4	−43.2	−15.33	− 9.83	41	10
Lauderdale	T	1,209	1,112	1,391	765	1,761	569	−13.6	−24.5	−10.47	−15.07	24	5
Haywood	T	1,207	1,115	1,880	875	1,283	423	−17.7	−36.5	− 9.89	− 8.28	17	2
Phillips	A	1,000	680	2,085	696	2,015	465	− 0.2	−31.2	− 6.79	−31.49	216	57
Coahoma	M	952	727	2,836	741	2,230	582	+ 7.8	−24.1	+12.91	−15.96	55	20
St. Francis	A	950	760	1,674	689	1,944	492	− 4.6	−34.2	+ 6.74	−18.57	54	17
Washington	M	934	525	2,637	670	2,117	806	+ 4.4	−21.7	− 0.91	−26.04	164	49
Leflore	M	918	564	2,784	595	1,928	581	− 2.6	−33.2	− 8.48	−16.97	79	23
Lee	A	874	824	1,704	647	1,992	458	−24.6	−42.7	−12.21	−21.42	3	1
Hardeman	T	865	673	1,166	521	965	373	− 9.0	−18.8	−12.81	− 3.58	13	2
Crittenden	A	823	664	2,042	644	2,536	600	+13.6	−26.0	+13.35	−18.89	42	13
Panola	M	781	451	899	470	876	287	−15.8	−39.2	−17.08	−20.40	47	8
Sunflower	M	744	622	1,665	544	2,336	866	−17.3	−37.8	−19.20	−24.11	13	6
Tunica	M	727	647	2,068	620	1,888	740	− 1.4	−30.5	+16.91	−10.16	17	5
Fayette	T	705	646	1,685	499	985	363	−23.8	−39.5	−15.30	−13.03	5	9
Benton	M	683	617	960	418	644	227	−49.1	−43.1	−19.32	−13.81	26	0
Bolivar	M	641	480	1,606	455	1,973	617	−11.7	−35.8	− 9.96	−25.66	22	6
Quitman	M	614	482	1,145	466	1,694	694	−14.9	−35.4	+11.11	−19.62	33	1
Tallahatchie	M	607	507	1,185	462	1,603	658	−23.0	−40.4	−15.93	−18.50	23	7
DeSoto	M	573	459	1,679	407	1,302	417	− 4.6	−40.3	− 7.69	−18.09	2	1
Tate	M	531	451	1,195	381	1,118	458	−17.1	−37.1	−14.36	−16.64	5	3
Marshall	M	505	439	1,341	396	859	239	−17.4	−30.5	−10.60	− 6.15	25	1
Total area		844[h]	$647[h]	$1,682[h]	$608[h]	$1,800	$501	+ 4.8	−25.4	−10.82	−19.67	$186	$58
Coefficient of quartile deviation		0.165	0.200	0.207	0.198	0.226	0.186	0.744	0.216	0.506	0.216	0.469	0.789

[a] Compiled from *United States Census, 1950, Population*, Tables 45, 45a, and 46.
[b] Compiled from *ibid.*, Table 49, and *ibid., Agriculture*, Volume II, County Table 7. Excludes the value of farm home consumption.
[c] Compiled from *United States Census, 1940, Agriculture*, Volume II, Part 2, County Table XVII, and *ibid., Population*, Volume II, Parts 1, 4, and 6, County Table 27.
[d] Annual births and deaths obtained from annual series, *Vital Statistics of the United States* Part II, *Place of Residence*. For the years 1940–44, the U. S. Bureau of the Census was the author; for the years 1945–49 the U. S. Public Health Service was the author. Estimates of birth underregistration obtained from U. S. Public Health Service, *Vital Statistics—Special Reports, Selected Studies*, "Birth Registration Completeness in the United States and Geographic Areas, 1950, Part II, Data for Local Areas," Volume 39, No. 4 (January 20, 1955).
[e] Compiled from *United States Census, 1940, Population*, Volume II, Parts 1, 4, and 6, Table 27 and *ibid., 1950*, Tables 49 and 49a.
[f] County values added by manufactures obtained from *United States Census, 1947, Manufactures*, Volume III. For certain counties having small numbers of manufacturing establishments, data are withheld from publication. However, the Bureau of the Census graciously provided aggregated data for two or more counties, from which the writer estimated allocations. Total population as reported by the Census for 1940 used in conjunction with the 1939 values. Reported populations for 1950 used in computing 1947 values.
[g] Capitalised single letter signified state location of each county, Arkansas, Mississippi, or Tennessee.
[h] Median of twenty-four counties.

from agricultural income data) the use of these 1949 data can be justified. Indeed, if population movements during the decade have been in the appropriate directions, disparities at the end of the decade are likely to be less than they otherwise might have been. Moreover, there appears to be no evidence that 1939 income disparities had been "overcorrected" by 1949.

Rank correlation results, summarized in Table 2, bear out the income selectivity of country population adjustment.[6] Thus, a highly significant correlation coefficient (+0.657**) appears between net county popula-

TABLE 2. RANK CORRELATION COEFFICIENTS (*rho*), BETWEEN INCOME, 1949, AND POPULATION CHANGE, 1940-50, BY SECTOR AND RACE

Item correlated with respective column heading	Percentage increase in total population, 1940-50	Estimated in-migration rates after adjustment for birth underregistration	
		White	Nonwhite
Median income, all races:			
All Sectors	+.657**	+.159	+.536**
Urban and rural nonfarm	+.526**	+.388*	+.432*
Rural-farm	+.558**	+.023	+.365*
Median income, all sectors:			
White	+.572**	+.451*	+.485**
Nonwhite	+.652**	+.378*	+.480*
Estimated average income, including value of farm home consumption:			
All sectors	+.611**	+.327	+.515**
Urban and rural nonfarm	+.533**	+.408*	+.494**
Rural-farm	+.318	—.134	+.186

Sources: Income data derived from *United States Census, 1950, Population,* Tables 45, 45a, and 46. Population change data derived from *ibid.,* Table 41 and *ibid., 1940, Population,* Volume II, Table 21. Estimated migration data: Table 1, *supra.*

tion increase and median county income, indicating that greatest rates of population increase tended to take place in those counties with highest income, and greatest rates of population decrease tended to take place in counties of lowest income. Although the writer did not estimate migration rates for the racially combined total population, he did, however, compute race-specific migration rates discussed subsequently.

[6] The writer used two measures of population adjustment, estimated net migration adjusted for birth underregistration, and, simply, net population change. In either case, he ranked greatest in-migration or population *increase* as highest, and greatest out-migration or population *decrease* as lowest in all relevant correlation computations.

Racial selectivity

For the same reasons that we found changes of total population to be related to income, we would expect to find similar results for race-specific income and migration data. This expectation is borne out by correlation results summarized in Table 2. Thus race-specific county migration rates correlated with race-specific county median incomes in significant degree (whites, +.451*; nonwhites, +.480*).

In addition to this intraracial selectivity of population change with respect to income, we can also expect inter-racial differences in migration if there is a racial difference in rewards to the labor factor. Abstracting from racially different income levels within the area, inter-racial migration selectivity could also reflect racial differences in the relative advantages of alternative job opportunities.[7]

Table 1 (Columns 4 and 5) indicate that county white median incomes for 1949 were in no case less than twice those for nonwhites, so that it is not surprising to observe (Columns 8 and 9) that county rates of migration are negative (*i.e.*, indicate out-migration) for nonwhites for all counties except Shelby. On the other hand, whites have in-migrated into several counties, and, where they have out-migrated, they have in most cases migrated at reduced rates as compared with nonwhites. For the area as a whole, estimated net migration for whites was inward and amounted to 24,872 for the decade. For nonwhites, migration was outward and amounted to 178,930. The racial difference in migration rates for Shelby county (which contains Memphis) should be noted: for nonwhites, a rate slightly above natural increase (3.2 per cent); for whites, a much higher rate (33.5 per cent). This, taken together with the opposite directions of aggregate migration by race, upholds the hypothesis that migration is racially selective. Evidently, more favorable employment opportunities for nonwhites existed outside the study area. On the other hand, more preferable employment opportunities for whites apparently existed within the area, since it not only retained its natural increase, but also (thanks largely to the city of Memphis) attracted in-migrants. These findings agree with the idea, frequently expressed, that Southern nonwhites must often travel greater distances to find satisfactory alternative employment opportunities than need Southern whites. Even though this

[7] For instance, in 1949 there was little incentive for whites to migrate from the Memphis Standard Metropolitan Area to the St. Louis Standard Metropolitan Area, but for Negroes there appeared to be a considerable advantage. For male whites over 13, 1949 median income in the Memphis area was $3,039, and in the St. Louis area, $3,017, suggesting little incentive for migration. For Negro males of similar age, however, the respective median incomes were $1,518 and $1,906, suggesting, despite the lower incomes to Negroes in both areas, stronger migration incentives. Source: *United States Census, 1950, Population,* Table 87.

finding is consistent with a race-discrimination hypothesis, it is also consistent with a hypothesis based upon the structure of the labor market in terms of nonracial qualifications such as education, health, and previous experience.

Selectivity by residential sector

For much the same reason as we expected to find racial differences in migration patterns, we expect to find differences with respect to residential sector. We can clearly see from Table 1 (Columns 2 and 3) that the median rural-farm income is lower in each county than that for the county as a whole. Because of the importance of income in kind to rural-farm population, this median income measure is somewhat inadequate because of its omission of that form of income. Average incomes per family and unrelated individuals computed from the same basic data, and including the estimated value of farm home consumption, tend to narrow the sectoral difference somewhat but continue to show lower incomes in every county for the rural-farm sector than for all sectors.

Although analogous data are not available for 1939, an alternative income estimate—gross value of farm products per farm worker[8] (which excludes nonfarm income)—is obtainable for that year as well as for 1949 (Table 1, Columns 6 and 7). Substantially similar results obtain with the use of "persons gainfully employed in agriculture" reported in the Census of Population or with the use of "man-year-equivalent farm workers"[9] in place of "farm workers" as measures of the agricultural labor force in this alternative measure. The lowest coefficient of quartile deviation (0.079) for 1949 resulted from a series which imputed the value of farm home consumption to income per "man-year-equivalent farm worker." This series correlated significantly (+.687**) with that for "gross value of farm products per farm worker."

Refinement of the values of farm production from a gross to a net basis, possible for 1939,[10] produces *increased* rather than decreased dispersion of incomes per farm worker. A large number of refined estimates based

[8] "Farm worker" is taken as the number of rural-farm males over 14.

[9] The estimated number of man-years engaged in agriculture. Nonfarm work by rural-farm residents estimated in 1939 from census enumerations of nonfarm work by farm operators; in 1949, estimated from the number of farm operators working 100 or more days in off-farm work. Farm work by nonfarm people based upon annual expenditures for hired labor and daily wage rates derived from data for states (1939) or for economic areas (1949). All conversions from a daily to an annual basis rest upon the assumption of a 250-day work year.

[10] Basically, these estimates rely upon estimates of state totals of farm expenditures made by the BAE. See U. S. Bureau of Agricultural Economics, *Income Parity for Agriculture* (Washington: U. S. Bureau of Agricultural Economics, 1945), Part VI, Section 1.

upon the value of agricultural production correlated highly with each other and indicated considerable dispersion of rural-farm incomes in each year considered. For 1949, despite the considerable difference between the treatment of nonfarm income in the two income measures, there was a significant correlation (+.367*) between county rural-farm median incomes and gross value of farm products (including estimated farm home consumption) per man-year-equivalent farm worker.

It is fortunate that we are able to make these estimates for both census years in order to be able to demonstrate the persistent nature of income differentials in the area. For any particular year, income variability could be explained in terms of transitory influences (occasioned, perhaps by price and yield instabilities), whereby disparate incomes over a period of years might offset each other and eliminate most of the intercounty income differentials found in a single year. A highly significant correlation (+.791**) between gross value of farm products per farm worker in 1939 and 1949 gives evidence that these disparities are persistent rather than transitory. Although we can not be quite so definite with respect to the nonfarm sector of the various counties, it is true that there was a considerable dispersion of incomes in the nonfarm sector for 1949 (C.Q.D. = 0.129) and a significant correlation (+.455*) between median incomes for the nonfarm sector and the rural-farm sector for 1949. These facts give us at least some basis for believing that county income differences for the nonfarm sector, as well as those for the rural-farm sector, have been persistent.

Although sufficient information is not available for reasonably good estimates of county migration by residential sector, there are highly significant relationships between race-specific migration rates and race-specific rates of population change (whites, +.835**; nonwhites, +.939**). These results permit the inference that rates of population change constitute good indexes of net migration. Generally higher rates of natural increase in rural than urban areas, and in rural-farm than in rural-nonfarm sectors,[11] tend to cause given rates of population decrease to understate out-migration for the rural-farm sector. However, in every county of the study area, rural-farm population has declined over the decade, and shows a greater rate of decline in all counties wherever

[11] See, for example: George W. Hill and Douglas G. Marshall, "Reproduction and Replacement of Farm Population and Agricultural Policy," *Journal of Farm Economics*, Volume XXIX, Number 2 (May 1947), pp. 457-474.

T. J. Woofter, Jr., "Trends in Rural and Urban Fertility Rates," *Rural Sociology*, Volume XIII, Number 1 (March 1948), pp. 3-9.

Margaret Jarman Hagood, "Changing Fertility Differentials Among Farm-operator Families in Relation to Economic Size of Farm," *Rural Sociology*, Volume XIII, Number 4 (December 1948), pp. 363-373.

there was a reduction of total population. For the area as a whole, rural-farm population decreased 16.92 per cent whereas total population increased by 8.65 per cent. This demonstrates that the sectoral selectivity of population movement is away from the rural-farm sector.

Moreover, this pattern appears to hold true for both racial groups. The percentage reduction of white rural-farm population was 10.82 as compared with the all-sector white population increase of 25.17 per cent. For nonwhites, the reduction in the area's rural-farm population was 19.67 per cent as compared with 3.51 per cent for the total nonwhite population. These changes have brought about increasing proportions of whites in the rural-farm residential sectors of almost all counties. In six of the twenty-four counties, however, white rural-farm population has actually increased, reflecting a substitution of white for nonwhite agricultural labor. This shift can be at least partially explained by the changing technology of cotton production, which requires higher levels of education and training for the utilization of new techniques. Educational achievement data[12] reveal that nonwhites attained no more than 60 per cent of white levels of median school years completed in any county of the study area, and that in most counties they attained considerably less.

Computation of population changes with respect to the "farm worker" category, *i.e.*, rural-farm males over 14, reveals still higher rates of population decrease for the study area over the decade (whites, 15.82 per cent; nonwhites, 31.01 per cent). As in the case of the total rural-farm white population, there were increases of white "farm-workers" in four of the twenty-four counties. However, these rates of increase were somewhat lower than for white rural-farm population as a whole. In all other counties rates of population decrease for whites were greater for rural-farm males over 14 than for the rural-farm population generally. For nonwhites this was true in all twenty-four counties. These greater rates of decrease for the labor force portion of the rural-farm population as compared with those for total rural-farm population testify to the income-responsive nature of migration and population adjustment.

Unfortunately, none of the income series available for the rural-farm sector is race-specific, so that our inferences will have to be based upon rural-farm incomes for both races taken together. Correlation results of sector-specific income and population change data, summarized in Table 3 (Column 2), reveal no significant relationship between population change and income for the total rural-farm population. This is true re-

---

[12] *United States Census, 1950, Population,* Tables 42 and 44. It should be noted that the median school years completed item as computed by the Census excludes those persons who have not completed the first year of school. Such an exclusion tends to distort comparisons of the educational attainment of the two races.

TABLE 3. RANK CORRELATION COEFFICIENTS (*rho*) BETWEEN FARM INCOME, 1939 AND 1949, AND POPULATION CHANGE, 1940-1950

Item correlated with respective column heading	Rates of population increase, rural-farm, 1940-50[a]					
	All ages, both sexes			Rural-farm males over 14		
	All races	White	Nonwhite	All races	White	Nonwhite
Estimates excluding nonfarm income:						
1939						
Gross value of farm products per:						
Rural-farm worker[b]	−.207	+.312	−.430*	−.592**	+.217	−.670**
Rural-farm man-equivalent-worker[c]	−.180	+.415*	−.439*	−.506**	+.307	−.672**
Estimated net value of farm products per rural-farm man-equivalent-worker[d]	−.101	+.266	−.406*	−.388*	+.319	−.586**
1949						
Gross value of farm products per:						
Rural-farm worker[b]	−.274	+.397*	−.568**	−.566**	+.355*	−.707**
Rural-farm man-equivalent-worker (including estimated farm home consumption)[e]	−.092	+.413*	−.430*	−.482*	+.197	−.560**
Estimates including nonfarm income:						
1949						
Incomes to rural-farm families and unrelated individuals:[f]						
Median	+.087	+.213	+.043	+.200	−.030	−.037
Estimated average (including value of home consumption)	−.137	−.184	−.087	+.159	−.405*	+.063

[a] Derived from *United States Census, 1940, Population,* Volume II, Tables 27 and 27a, and *ibid., 1950, Population,* Tables 49 and 49a.

[b] Table 1, *supra.*

[c] Estimates of nonfarm work derived from *United States Census, 1940, Agriculture,* Volume II, County Table IX, Line 19. Estimates of farm work by nonfarm people derived from cash wages paid for hired workers, *ibid.,* County Table X, Line 31, and daily cash wage rates from U.S. Bureau of Agricultural Economics, *Farm Wage Rates, Farm Employment and Related Data* (Washington: U.S. Bureau of Agricultural Economics, 1943).

[d] See Footnote 10.

[e] Estimates of nonfarm work derived from *United States Census, 1950, Agriculture,* County Table 1, Line 85. Estimates of farm work by nonfarm people derived from cash wages paid for hired workers, *ibid.,* County Table 3, Line 73, and daily cash wage rates from *ibid.,* Economic Area Table 2, Line 50.

[f] Derived from *ibid., Population,* Tables 45 and 46.

gardless of the income year considered (1939 or 1949), or regardless of the inclusion or exclusion of nonfarm income or farm home consumption. Upon narrowing the rural-farm population base to rural-farm males over 14, we find (Column 5) a *negative* relationship between income and population change for both years for income estimates excluding income to farm workers from nonfarm sources. No significant relationship develops for 1949 with the inclusion of nonfarm income.

Further insight into this matter develops from an examination of the race-specific rates of population change. Thus, for the total white rural-farm population (Column 3), we find that the significant correlation coefficients are all positive; for nonwhites (Column 4), we find that the significant relationships are negative. However, it should be noted that the income estimates which include income from nonfarm sources are not significant for either race. Narrowing of the rural-farm population base to rural-farm males over 14, results in only two statistically significant relationships, and these are contradictory in nature. For nonwhites, however, highly significant negative relationships result with income estimates excluding nonfarm income.

We can conclude from these data that population movements of the rural-farm sector as a whole are *not* corrective among counties in an income equilibrating sense. There is some indication that this represents two racially diverging trends, *i.e.*, counties of highest agricultural income per worker have tended to gain (or lose less) of the rural-farm white population, but have tended to lose more of the rural-farm nonwhite population, as compared with counties of lowest agricultural income per worker. Upon narrowing the population base to that of the male labor force, the nonequilibrating tendency of the nonwhite population movement seems apparent, and this tendency is so strong as to override corrective tendencies with respect to the white male labor force. The inclusion of nonfarm income is in no case sufficient to bring about an indication of an income-equilibrating tendency, in fact, among whites it either eliminates such a tendency, or has the effect of making it significantly negative.

Although, conceivably, race-specific income data, if available, might reveal significant positive income-population adjustment correlation, this does not appear to be a likely possibility. Even if it were, however, the over-all effect of population adjustment for the rural-farm sector for both races combined would continue to be nonequilibrating. Does this mean then that population adjustment and migration as they pertain to the rural-farm sector are not related to income considerations? Quite clearly this does not appear to be true. In the first place, we have observed the greater exodus of population among the male labor force members as

compared with the total population including nonmembers of the labor force. In the second place, the very magnitude of the population movements tends to deny this in the absence of a widespread natural calamity within the area during the decade. In the third place, it appears that, for both whites and nonwhites, the bulk of attractive employment alternatives were neither local nor agricultural. Whites tended in large part to migrate to Memphis, and nonwhites, to migrate out of the area, presumably to Northern and Western cities. Therefore, in a context in which nonlocal alternative income opportunities may be the most relevant ones, and in which rates of movement are very high, other influences may override the usual income considerations. For instance, job information, family connections, and similar matters may have proximate determining influence. It may also be true that training in the use of agricultural technology found in the higher income counties may open wider possibilities for farm workers with respect to alternative opportunities. The training involved in learning to operate or repair a tractor or cotton harvesting machine may provide a skill which increases population mobility more in high-income relative to low-income counties. Still another aspect of this problem is the discouragement of population replacement by in-movement through the elimination of croppers' cabins in areas of advanced cotton technology.[13]

None of the data examined support the view that there are strong attachments within the area to employment in agriculture or to living on a farm as a particular way of life. In fact, the high rates of population reduction support the view that the rural-farm people within the area readily respond to alternative nonfarm opportunities and that they are often willing to travel considerable distances in order to do so. It is important to notice that out-migration has proceeded at rates sufficiently rapid to offset the high rates of natural increase in the rural-farm sectors of even the counties of lowest income, despite the lack of equilibrating influence of population movements with respect to these local areas in the short run. We may say, then, that population movements have been in the appropriate direction for easing the problems of low income in the rural-farm sector of the area generally, even though they may have increased income dispersion within the area. All of which supports the view that geographically redistribution of large segments of the population in response to ordinary employment incentives takes long periods of time. A decade (even one of remarkably consistent levels of "full employment" in urban centers) constitutes a "short-run" rather than a "long-run" adjustment period under such circumstances.

[13] Harald A. Pedersen, and Arthur F. Raper, *The Cotton Plantation in Transition*, Bulletin 508 (State College, Mississippi: Mississippi State College Agricultural Experiment Station, 1954).

Migration and local manufacturing development

The well-known proposition that local industrial-urban development plays a key role in economic development[14] has led to computations based upon the value added by manufactures per capita as an index of industrial-urban development.[15] In this study area, the size of such an industrial-urban base, by counties, correlates significantly with race-specific migration rates (whites, +.528**; nonwhites, +.521**). Thus, in a context in which farm incomes are lower than nonfarm incomes, counties with the largest per capita value added by manufactures tended either to attract in-migrants at more rapid rates, or to hold down rates of out-migration, relative to those with lower per capita values. A measure of industrial-urban growth, per capita increase in value added by manufactures, 1940-50, correlates significantly with race-specific migration rates (whites, +.436*; nonwhites, +.497**), and testified further to the responsiveness of population adjustment to local manufacturing opportunities.

II. Adjustment of Agricultural Production Factors

The large reduction of the area's agricultural labor force during the 1940-50 decade would be expected to result, with reasonably efficient factor markets, in changes in factor combination. Assuming a relatively inelastic supply of land and no reduction in capital, a more extensive use of labor would result. This implies a more intensive use of land with respect to labor. Assuming any increase in the accumulation of capital, we would expect land to be used more extensively with respect to capital. Greater capital intensivity with respect to both land and labor would follow from the assumptions cited. Moreover, again assuming reasonably efficient factor markets, we would expect these adjustments to be income-equilibrating from county to county.

Labor

The acreage of land in farms per farm worker within the study area amounted to 32.07 acres in 1940 and to 46.77 acres in 1950, an increase of 45.8 per cent. Analagous data for Iowa, useful as a benchmark, show comparable acreages of 95.45 and 119.39 acres respectively for the two census years. Although the Iowa increase represents a smaller percentage

---

[14] Theodore W. Schultz "A Framework for Land Economics—The Long View," *Journal of Farm Economics*, Volume XXXIII, Number 2 (May 1951), pp. 205-6.

[15] In addition to published progress reports cited in footnote 1, see: Fletcher E. Riggs, "An Analysis of Southern Economic Development with Particular Reference to Agriculture: Upper Tennessee Valley, 1900-1940." Unpublished Ph.D. dissertation, Vanderbilt University, 1956.

gain (25.08) per worker, the absolute increase for Iowa was 86 per cent more than that for the study area. This provides some idea of the magnitude of the adjustment necessary for the equalization of the man-land ratio of a low-income area with that of a high-income area and emphasizes the tendency for geographical dispersion of the resource base to increase rather than decrease. This is not to say that an equalization of the man-land ratio is a necessary condition of income equilibration, although, it is noteworthy that each area has moved in the direction of less labor intensity with respect to land.

Inasmuch as we shall see below that there appears to have been net capital investment within the area, and little or no likelihood of net disinvestment, increased extensiveness of labor use becomes apparent.

Land

Contrary to our expectations of finding a fixed or even a declining (in view of the withdrawal of agricultural land for residential purposes in the Memphis and other areas) supply of land in farms within the study area, the farm acreage actually increased over the decade—from 7,347,000 acres in 1940 to 7,906,000 acres in 1950. It is unlikely that the slightly different definition of a "farm"[16] employed in the two censuses can explain the difference. Perhaps the explanation lies in clearing and draining of additional land,[17] the incorporation of abandoned acreage into farms, and the acquisition of timber lands by farmers. Moreover, there was also an increase in harvested acreage during the decade—from 3,949,000 to 4,048,000 acres. This increase, taken together with the large proportion of total land in farms harvested, provides evidence of the continued reliance upon row and other harvested crops as the important source of agricultural income in this area.[18]

Because of the noncomparability of many classifications of land as reported by the census, comparisons with respect to land in pasture are difficult. Although almost every county seems to have shown an increase of woodland pasture acreage, the trend with respect to "plowable" pasture or "cropland pasture" appears to have been in the opposite direction. Apparently, judging simply from the designated use of land in farms, pressure seems to have been exerted against both the intensive margin, through the greater use of harvested crops, and against the extensive

---

[16] *United States Census, 1950, Agriculture*, Volume I, p. xii.

[17] Paul S. McComas, Troy Mullins, E. L. Langsford, *Farming New Land in the Yazoo-Mississippi Delta* (Washington: U. S. Bureau of Agricultural Economics, 1942).

[18] In both years, cotton and corn acreage combined amounted to more than three quarters of the acreage harvested. Largely because of acreage restrictions in 1939, cotton acreage was cut back, but appears to have been largely offset by corn.

margin, through the greater use of woodland pasture and the incorporation of woodland into farms.

It should be emphasized that land use within the areas has become more intensive with respect to labor, but, as we shall see, more extensive with respect to capital.

Capital

There are three principal categories of capital to consider: buildings, implements and machinery, and livestock. Census value data, although available for all three categories for 1940, are available only for livestock for 1950. Fortunately, however, production expense and physical data are adequate to show that there has been a net real accumulation of capital over the decade.

With respect to the investment in buildings, there was probably little net investment over the decade. In general, because of the departure of population and reduction of livestock numbers, disinvestment or conversion would be expected of tenant houses,[19] stables, sheds, and chicken and hog shelters. To a certain extent this would be offset by increases in the dairy enterprise of a few counties and by the construction of machinery sheds to house the increased numbers of farm machines, but, because of the ease of conversion of many of the obsolescent buildings to alternative uses, there was, on balance, probably little net real investment in buildings during the decade.

Indicative of the increased real investment in implements and machinery over the decade are the following rates of increases of physical numbers of machines: tractors, 145 per cent; motor trucks, 199.8 per cent; and automobiles, 44.7 per cent. Although the writer did not attempt to consider the relative ages of vehicles or their relative real unit values, it does appear that there has been a considerable net real investment in implements and machinery over the decade. If we were able to obtain census data with respect to newly developed machinery used in cotton production this investment would appear to be even larger.

In real terms there appears to have been a net disinvestment of livestock during the decade. Even though there are slight differences in the reporting basis, values of livestock are generally comparable in dollar terms over the decade. In 1950, the value of all specified livestock amounted to $56,704,000, an increase of 57.6 per cent over 1940. This amount includes the value of horses and mules, which decreased by 53.1 per cent, and the value of all other livestock, which increased by 269 per cent. Using national price data for principal classes of livestock, 1950

[19] Harald A. Pedersen and Arthur F. Raper, *op. cit.*

values of farm animals in the area were adjusted to 1940 prices.[20] The result indicates a disinvestment of livestock in real terms over the decade amounting to about twenty per cent.

Assuming an unchanged level of real investment in buildings, a highly conservative estimate of the real increased investment in implements and machinery of 100 per cent, and an adjusted value of specific livestock of $28,991,000, one obtains an estimate in 1940 dollars of the area's invested capital for 1950 of $166,361,000, a 14.3 per cent increase over 1940. This the writer regards as a minimum estimate of the real increase of farm capital (excluding capital investments in land) for the decade.

County factor adjustments

We have already seen that adjustments of the rural-farm labor force have not responded with respect to income in a manner such as to correct county income differences within the study area. However, it behooves us to examine the intercounty adjustments of other factors with a view to determining whether such adjustments are corrective or noncorrective.

Table 4 demonstrates that land and capital investment per worker is almost invariably greatest in the highest income counties. Significant positive correlation coefficients shown in the upper part of Table 4 indicate this, directly or indirectly. Thus we find evidence of greater investment in harvested acreage, and of values of land, buildings, implements and machinery for numerous combinations for both census years. Expenditures and physical data related to implement and machinery investment indicate the same tendency for 1950 as for 1940. Only with respect to the physical measure of total land in farms per worker and with respect to investment in livestock, are the significant correlations negative, *i.e.*, indicative of greater investment per worker in the lowest counties. However, as indicated by the significant positive coefficient for the total value of buildings, implements and machinery, and livestock, obtainable for 1940, the investment in other capital more than offsets the investment in livestock. These data reflect the unequal resource base per worker within the study area, and provide clues as to the magnitude of factor adjustment necessary for income equilibration.

Evidence presented in the lower portion of Table 4 testifies that these factor adjustments have not proceeded in corrective fashion. A significant positive correlation coefficient here signifies that the greatest intercensal increases in per worker investment have taken place in the highest

[20] Data from *Agricultural Statistics* reveal, generally, that prices of draft animals declined and that prices of meat animals increased from 1940 to 1950. As a rough estimate, the writer used an index number of 80 to adjust the 1950 dollar values of horses and mules, and an index of 300 for all non-draft livestock.

TABLE 4. RANK CORRELATION COEFFICIENTS (*rho*) BETWEEN GROSS VALUE OF FARM PRODUCTS AND SUNDRY AGRICULTURAL DATA, RURAL-FARM WORKER CRITERION

Item correlated with respective column heading	Gross value of farm products per rural-farm worker	
	1939	1949
Per rural-farm worker:		
Harvested acres, 1940	+.660**	
Harvested acres, 1950		+.889**
Land in farms, acres, 1940	−.716**	
Land in farms, acres, 1950		−.670**
Value of land and buildings, 1940	+.777**	+.758**
Value of buildings, 1940	+.428*	+.578**
Value of land, 1940	+.818**	+.781**
Value land and buildings, 1950		+.766**
Value of implements and machinery, 1940	+.708**	+.711**
Number of tractors, 1940	+.747**	
Number of tractors, 1950		+.565**
Expenditures for gasoline, etc., 1939	+.889**	
Expenditures for gasoline, etc., 1949		+.814**
Expenditures for farm machinery repairs (other than tractors), 1949	+.620**	+.838**
Value of all specified livestock, 1940	−.737**	
Value of all specified livestock, 1950		−.847**
Value of specified livestock (excluding horses & mules), 1940	−.793**	
Value of specified livestock (excluding horses & mules), 1950		−.841**
Value of buildings, implements, machinery & all specified livestock, 1940	+.509**	+.485**
Increase in harvested acreage, 1940-50	+.621**	+.747**
Increase in all farm acreage, 1940-50	−.263	−.201
Increase in gasoline expenditures, 1940-50	+.783**	+.913**
Increase in value of all specified livestock, 1940-50	−.805**	−.797**
Increase in value of specified livestock (excluding horses & mules), 1940-50	−.739**	−.834**

Sources: Table I, *supra*, and computations from *United States Census, 1940, Agriculture*, and *ibid., 1950.*

income counties. Increases in per worker harvested acreages and in per worker gasoline expenditure (taken as an index of increased investment in machinery and equipment) have clearly followed a noncorrective pattern. With respect to the increased investment in livestock, however, the pattern was corrective, but, most probably, in insufficient degree to counteract the noncorrective pattern for implement and machinery investment. This is particularly likely to be so in view of the net disinvestment of livestock for the area as a whole, and the greater tendency

TABLE 5. RANK CORRELATION COEFFICIENTS (*rho*) BETWEEN GROSS VALUE OF FARM PRODUCTS PER RURAL FARM WORKER AND SUNDRY AGRICULTURAL DATA, ACREAGE CRITERIA

Item correlated with respective column heading	Gross value of farm products per rural farm worker	
	1939	1949
Per harvested acre:		
Value of buildings, 1940	+.252	+.202
Value of implements & machinery, 1940	+.543**	+.440*
Number of tractors, 1940	+.735**	
Number of tractors, 1950		−.266
Expenditures for gasoline, etc., 1940	+.667**	
Expenditures for gasoline, etc., 1950		+.844**
Farm machinery repairs (other than tractors), 1950	+.543**	+.414*
Value of specified livestock, 1940	−.750**	
Value of specified livestock, 1950		−.834**
Value of specified livestock (excluding horses & mules), 1940	−.793**	
Value of specified livestock (excluding horses & mules), 1950		−.824**
Value of buildings, implements, machinery & livestock, 1940	−.224	−.351*
Increase in gasoline expenditures, 1940-50	+.763**	+.847**
Increase in value of livestock, 1940-50	−.747**	−.923**
Increase in value of livestock (excluding horses & mules), 1940-50	−.715**	−851**
Per acre of land in farms:		
Value of specified livestock, 1940	+.274	
Value of specified livestock, 1950		−.823**
Value of specified livestock (excluding horses & mules), 1940	−.521**	
Value of specified livestock (excluding horses & mules), 1950		−.611**

Sources: Table 1, *supra*, and computations from *United States Census, 1940, Agriculture*, and *ibid., 1950.*

of the high-income counties to disinvest horses and mules as a power source and to invest in machinery.[21]

Table 5 summarizes relationships based upon the capital-land factor combination. In this case it does not appear that the highest income counties are those with the greatest capital investment per harvested acre to judge from the nonsignificant relationship between the 1940 county value of buildings, implements and machinery, and livestock and county

[21] It may come of something of a surprise to some readers to learn that, in a decade of rapid mechanization, both within the study area and the nation, the number of horses and mules on farms increased in ten of the twenty-four counties considered.

income. However, the form that the capital investment takes differs significantly with respect to income. Thus, no significant relationship for the per acre value of buildings results, but the highest income counties are those with the greatest investment in implements and machinery per acre and the smallest investment in livestock. It is apparent also that the upper income counties are those that tend to first make significant innovations. Thus, in 1940, the number of tractors per acre correlated highly with income, but, by 1950, the coefficient had become negative but in a nonsignificant degree. At the same time, however, gasoline expenditures per acre correlate more significantly with income in the more recent year, permitting the inference of greater use of newer nontractor machinery in the highest income counties in 1950.

Intercensal changes in per acre investment emphasize the importance and opposite relationship of two forms of capital—machinery and livestock. Increased investment per acre in the form of implements and machinery appears to be noncorrective, and investment in livestock appears to be corrective. However, it does seem that the increased investment in draft animals in counties of lowest income may not be an appropriate one for income equilibration. Taking this into account as well as the greater probably magnitude in the increase of machinery investment per acre and per worker, changes in capital investment appear to have been noncorrective over the decade.

III. Summary

The study area, significant because of its contribution to American cotton production, and interesting because of its low levels of agricultural income in an area of highly productive soils, provides a basis for the study of economic development during 1940-50 in an area containing a metropolitan center. Geographical disparate county incomes, found to be persistent, relate to rates of migration and population change in such a way as to indicate these changes tend to be income equilibrating for all-sector county populations regardless of race. For the rural-farm residential sector, however, rates of population change tend not to be income-equilibrating with respect to county differences. In fact, with respect to nonwhites, these changes appear to be anti-equilibrating, especially for the labor force portion of the nonwhite rural-farm population. Nonetheless, for the area as a whole, lower income groups, *i.e.*, nonwhites and rural-farm people of each race, tend to have selectivity higher rates of out-migration, indicating an over-all tendency to ease the low-income problem in the area. The presence of local manufacturing industry tends to attract in-migration or lessen out-migration, in an equilibrating fashion, testifying to the importance of local employment alternative to agricul-

ture in an economic development context. However, local alternative employment opportunities for nonwhites were not sufficiently attractive to restrain the exodus of large numbers of nonwhites from the area.

Agricultural factor combinations and changes in them over the decade, although in the direction of easing the problem of low income for the area as a whole, tended to do so in ways likely to increase income dispersion within the area. In general, the counties with highest agricultural incomes, tended to have been those with largest per worker investment in capital items, and those best able to increase harvested land acreage and capital investment per worker. This development is most noticeable with respect to investment in implements and machinery. Lowest income counties had greater per worker investment only in livestock, comprising a minor proportion of total capital, and larger (though less valuable) acreages of land in farms per worker. With respect to capital investment per harvested acreage, the highest income counties are those with the greatest per acre investment in machinery and those best able to increase such investment over the decade. The investment in livestock per land unit and changes in such investment tended to be greatest in counties of lowest income, in this way tending to be income equilibrating. However, the fact that much of the livestock investment is in the form of draft animals emphasizes the less modern techniques used in the lower income counties.

Persistence of the observed trends of population change and factor combination for the rural-farm sector presages greater geographical dispersion of agricultural incomes in the area at somewhat higher levels. Geographical equilibration of county incomes calls for still higher rates of population exodus as well as for changes in the amount and form of capital investment in counties of lowest income. An expeditious solution to this problem of income disparity suggests the advisability of close scrutiny of current agricultural policy with respect to the amount and, particularly, to the direction of agricultural benefits.

NOTES

NOTE ON FARM TENANCY AND URBANIZATION*

OTIS DUDLEY DUNCAN
University of Chicago

PREVIOUS research has shown that rural people living in the vicinity of large cities differ systematically from the more isolated rural population in a number of significant demographic and socio-economic characteristics. For example, in terms of the classification employed in this paper, 47 per cent of the rural-farm employed males in the most urbanized counties of the United States were engaged in nonfarm occupations in 1950, as compared with only 22 per cent in the least urbanized counties.[1]

Observations like this have suggested three major hypotheses concerning rural-urban relationships that bear on the economics of agriculture:

(1) Rural areas near cities undergo "suburbanization" or "fringe development" when urban people take up rural residences on the periphery of the urban community.[2] This population movement may be prompted by industrial decentralization, or it may be a strictly residential shift. In either case, a segment of the population which is nominally rural by residence, and which may even engage in some agricultural production, remains city-oriented in terms of primary economic activity and social relationships.

(2) With improvements in communication and transportation and a rising rural level of living, the social and economic opportunities of the city become more accessible to rural residents in the immediate hinterland, supplementing those based on agricultural activity and focused in the rural community. Thus there ensues a "rurbanization" of the rural population.

(3) As some agricultural economists believe, the agricultural sector of the economy operates more efficiently in locations accessible to the foci of economic development;[3] or, as Lösch put it, ". . . in a dynamic economy

* Revised version of a paper presented at a meeting of the North Central Land Tenure Research Committee in Chicago, April 19, 1956. The author gratefully acknowledges the financial support of the Social Science Research Committee, University of Chicago, and the clerical assistance of Nathaniel Hare.

[1] Otis Dudley Duncan and Albert J. Reiss, Jr., *Social Characteristics of Urban and Rural Communities, 1950* (New York: John Wiley and Sons, 1956), Chapter 13; see also Otis Dudley Duncan, "Gradients of Urban Influence on the Rural Population," *Midwest Sociologist*, 18 (Winter 1956), 27-30.

[2] See Interregional Land Tenure Research Committee, *Agricultural Land Tenure Research* (Chicago: Farm Foundation, 1955), pp. 29-30.

[3] Theodore W. Schultz, *The Economic Organization of Agriculture* (New York: McGraw-Hill, 1953), p. 147.

Thünen rings must be formed."[4] Human ecologists have subsumed this hypothesis under "metropolitan dominance."[5]

The purpose of this note is not to resolve the differences among these hypotheses or to assess their relative importance. Instead, it calls attention to some empirical relationships considered worthy of further study under any of them.

Table 1 summarizes cross-sectional relationships between certain

TABLE 1. SELECTED CHARACTERISTICS OF FARMS, BY TYPE OF COUNTY, FOR THE UNITED STATES: 1950

Characteristic	All counties	Metropolitan counties, by size of largest place in S.M.A.		Nonmetropolitan counties, by size of largest place in county	
		250,000 or more	Under 250,000	25,000 or more	Under 25,000
1. Per cent distribution of farms					
United States	100.0	5.2	6.5	6.8	81.5
2. Per cent of farms operated by tenants					
United States	26.8	13.4	19.0	23.3	28.6
Weighted mean of divisions					
Observed	26.8	18.4	23.1	26.3	27.3
Standardized for economic class	26.8	20.8	25.2	26.6	27.1
3. Per cent of tenant farms operated by cash tenants					
United States	14.7	37.6	21.6	16.8	13.5
Weighted mean of divisions	14.7	30.4	20.8	16.3	13.9
South, omitting croppers	21.5	37.3	28.3	22.7	20.8
4. Full owners as per cent of all owners and managers					
United States	78.5	84.5	83.2	81.1	77.3
Weighted mean of divisions	78.5	83.5	82.0	80.4	77.9
5. Per cent of operators working off farms 100 days or more in 1949					
United States	23.3	39.7	34.5	28.0	21.0
Weighted mean of divisions	23.3	40.1	33.8	26.9	21.7
6. Per cent of farms with nonfarm family income exceeding farm income in 1949					
United States	29.1	41.9	37.9	31.9	27.3
Weighted mean of divisions	29.1	43.2	38.6	31.5	27.8
7. Commercial farms as per cent of all farms					
United States	68.8	57.6	60.9	67.2	70.3
Weighted mean of divisions	68.8	53.8	58.5	66.5	70.2
8. Per cent of commercial farms in economic classes I and II					
United States	13.3	22.2	19.4	16.0	12.2
Weighted mean of divisions	13.3	18.7	17.6	14.4	12.8

Source: *1950 Census of Agriculture.*

[4] August Lösch, *The Economics of Location* (New Haven: Yale University Press, 1954), p. 57.

[5] Donald J. Bogue, *The Structure of the Metropolitan Community* (Ann Arbor: University of Michigan, 1949).

characteristics of farms, including tenancy, and the degree of urbanization of the counties in which they are located. Counties were classified as metropolitan if they were wholly—or in New England partly—inside standard metropolitan areas (S.M.A.'s). Metropolitan counties were dichotomized according to the size of the largest urbanized area in the S.M.A., and nonmetropolitan counties according to the size of the largest urban place in the county. These classifications produced four groups of counties, assumed to vary from high to low in urbanization. Not quite one-fifth of the farms fell in the three groups of counties considered moderately to highly urbanized (Table 1, panel 1). County data on farm characteristics in 1950 were aggregated to secure summary figures for the four groups of counties, the computations being carried out for the country as a whole and for each of the nine census geographic divisions.

The data reveal significant urbanization gradients for the incidence of farm tenancy, the form of tenure, and farm characteristics related to tenancy. The proportion of farms operated by tenants was more than twice as great in the least urban counties as in the most urban counties (panel 2). The relative frequency of cash tenants among all tenants was nearly three times as great in the most urban as in the least urban counties (panel 3). Similarly, the proportion of full owners among all owners and managers was directly related to urbanization (panel 4).

Before commenting on these results, one should examine certain obvious factors affecting their interpretation. It might be suspected that the urbanization gradient in incidence of tenancy merely reflects geographic differentials in both tenancy and urbanization. Inspection of the divisional data (not shown here) reveals, however, that in each of the seven divisions outside the Northeast, the tenancy proportion was higher in the least urban than in the most urban counties. The second line of panel 2 reports averages of the divisional percentages computed so as to eliminate variation in the divisional distribution of the type-of-county groups; i.e., divisional percentages were averaged with a constant set of weights, the percentage distribution of all farms by division. These averages still exhibit an urbanization gradient, but one that is less steep than that shown by the unadjusted figures. It should be observed that the divisional averages understate the urbanization effect, inasmuch as there is a between-division relationship of tenancy to urbanization, in addition to the relationship within divisions, as may be seen from the following tabulation:

Division	Per cent of farms in least urban counties	Per cent of farms operated by tenants
Pacific	51.1	10.6
Middle Atlantic	51.7	7.9
New England	54.6	3.7

Division	Per cent of farms in least urban counties	Per cent of farms operated by tenants
East North Central	74.3	19.8
South Atlantic	84.6	32.1
Mountain	85.3	16.0
West North Central	89.3	28.2
West South Central	89.4	33.7
East South Central	90.8	36.6

Tenancy proportions by division, therefore, reflect an interaction between geographic and urbanization effects; an allocation of some fraction of the interaction to urbanization would result in an urbanization gradient intermediate between those of the first two lines of panel 2. (Similar comments apply, in varying degree, for the other farm characteristics covered in Table 1.)

Aside from geographic differentials, the incidence of tenancy also varies considerably according to economic class of farm, which, in turn, exhibits an urbanization gradient. Panels 5 and 6 show that the relative importance of off-farm employment and nonfarm income varies directly with degree of urbanization. Since these factors are involved in the classification of farms as commercial and noncommercial, the proportion of commercial farms varies inversely with urbanization (panel 7). But within the category of commercial farms, there is a distinct tendency for the proportion of larger farms (in terms of economic size) to vary directly with urbanization. The proportion of commercial farms in economic classes I and II (value of products $10,000 or more) was nearly twice as high in the most urban as in the least urban counties in 1950 (panel 8).

Evidently, tenancy differentials by degree of urbanization may reflect variations in the relative frequency of noncommercial (part-time, residential, and abnormal) farms and the average economic size of farms. For the United States as a whole, in 1950, the tenancy proportion for noncommercial farms was only slightly more than one-half as great as that for commercial farms; and tenancy was inversely related to economic class, within the category of commercial farms, though this was not the case in all geographic divisions. To hold constant the effects of these factors, the tenancy proportion in each type-of-county group in each division was standardized, by the indirect method, for economic class, making use of tenancy proportions specific for division and economic class. (There are seven classes altogether, six classes of commercial farms according to value of products, and the seventh class of noncommercial farms.) The weighted averages of the standardized divisional figures appears in the third line of panel 2. These results make it clear that part of the urbanization gradient in tenancy can be explained by the covariation of economic class of farms and urbanization. Nonetheless, a distinct

inverse relationship of tenancy to urbanization remains after statistical elimination of the economic class effect. The net relationship shown, is, for the reasons already indicated, a minimum statement of the urbanization effect.

In qualification of the foregoing results, it must be acknowledged that the within-division urbanization gradients in tenancy were not all as regular as those shown for the United States. Rather, there was a general tendency for the urbanization gradient to be most pronounced in those divisions with comparatively high over-all tenancy proportions and low average urbanization.[6] The disproportionate share of the country's farms concentrated in these divisions weights the national results heavily.

Additional qualifications pertain to any cross-sectional analysis of the effects of urbanization. The decline in tenancy proportions since the 1930's is consistent with the urbanization trend, but the increase in tenancy from 1880 to 1930 is not. It is perhaps significant, however, that the decline in tenancy began first in the most urbanized region of the United States, the Northeast. Only historical comparisons of changes in tenancy and urbanization could distinguish the longitudinal effects of urban expansion on agricultural land tenure from the cross-sectional relationships between these variables.

A final comment on the study concerns the relatively crude units and classifications employed. More refined techniques will obviously be required to reach an explanation of the empirical relationship demonstrated here. The writer believes that further manipulation of county-unit data may clarify aspects of the problem, particularly if the analysis combines a cross-sectional with a time-series approach. But it will be possible to formulate an adequate description of the impact of rural-urban relationships on farm tenure only on the basis of carefully conducted field investigations.

---

[6] Space limitations preclude publication of the divisional figures, but the author will supply a set of tables for divisions, paralleling Table 1, upon request.

THE INCOME POSITION OF WEST GERMAN AGRICULTURE: A REVIEW NOTE

PHILIP M. RAUP
University of Minnesota

UNDER the title *Die Landwirtschaft in der Volkswirtschaftlichen Entwicklung*,[1] Dr. Hilde Weber of the *Institut fuer Agrarpolitik and Marktforschung*, University of Bonn, has struggled with one of the thorniest agricultural problems of our times: The seemingly endemic incapacity of agriculture to maintain its income position vis-a-vis the nonagricultural sector. In this sense, the monograph may be regarded as a German variation on the theme that infused Professor T. W. Schultz's *Agriculture in an Unstable Economy* a decade earlier.

For agriculture in general, and a peasant agriculture in particular, a period of economic crisis is often one in which the agricultural share of the national income is, percentagewise, at its peak. German agriculture was given favored attention under national socialism and this continued throughout the war years. The postwar collapse and the "suppressed inflation" of 1945-48 found the German farmer in a preferred status, relatively speaking, and kept him there. The economic recovery that followed the currency reform of 1948 has not excluded agriculture, but the German farmer has not been among its principle beneficiaries.[2] He sees himself falling behind.

One consequence of the phenomenal postwar German economic revival has been the appearance of peasant demands for "parity" in agriculture. As in the United States, this aspiration is keenly felt but not clearly formulated. Some proposals have involved price parity for agriculture, and seem to be almost direct borrowings from the American scene. Other proposals have focused on income parity and have sought support in the fact that, however measured, neither global nor average incomes in German agriculture have kept pace with nonagricultural incomes in the post-1948 years. In this setting (all too familiar to American readers), the essay ably draws together and underlines the key points that face agricultural research workers and policy makers who would struggle with today's "farm problem."

The first half is devoted to a summary review of the historical development of agriculture as a structural part of various economic systems. Emphasis is laid on three trends that influence modern agriculture in the

[1] *Berichte Ueber Landwirtschaft, Sonderheft 161*, Hamburg and Berlin, Verlag Paul Parey, 1955, pp. 104.

[2] See Hubert G. Schmidt, "Postwar Developments in West German Agriculture, 1945-53," *Agricultural History*, Oct., 1955, and Philip M. Raup, "Postwar Recovery of Western German Agriculture," *Journal of Farm Economics*, February 1950.

Western world: the (relatively) slow rate of population growth, the peculiarities of demand elasticity for food, and the differential rates of increase in the physical output of industry and agriculture. Heavy reliance is placed on Colin Clark, J. A. Schumpeter, and T. W. Schultz (there are more than thirty citations to these three authors in the first fifty pages). Weber concludes that for Western agriculture (in contrast to Asia and the Middle East), the major problem is not the Malthusian spectre of want, but the problem of productivity. In theory, agriculture could control its rate of output and benefit from the higher income that an inelastic demand for food would guarantee. In fact, agriculture has made no successful use of this procedure.

As a consequence, technical progress that acts to increase output carries with it the seeds that destroy any consequent economic advantage. There is no novelty in this argument, but it is noteworthy to have it documented with data from a truncated Germany, less than 10 years after a disastrous war.

The second half of the monograph examines attempts that have been made to measure the "underevaluation" of agriculture, and of policies that have been proposed to redress this imbalance. It is this section that will be of primary value to the American reader. Weber is properly critical of the concepts of "income proportionality" that have led some researchers to measure agriculture's position in terms of its income as a fraction of total national income. (Louis Bean in the United States and W. Bauer and P. Dehen in Germany bear the brunt of this critique.) In Germany, agriculture's share of national income was greater in 1931-34 than in 1927-29, yet its true income position was unquestionably worse in the depression period. Proportionality is not a valid measure.

A major problem in any appraisal of the position of agriculture in a national economy involves the range or scatter in the income distribution pattern. This is illustrated for West Germany with data showing the distribution of cash farm income per household, by size of farm, for four types of farming in which principal emphasis falls on: (1) sugar beets, (2) cash grain, (3) fodder production, and (4) forage utilization. Only for sugar beets is any well defined relationship apparent between gross cash income and size of farm. Here the coefficient of simple correlation between income (in 1,000 DM) and size of farm in hectares is .72. For cash grain farms it is .60, and .41 and .39 for fodder-producing and forage-using farms, respectively. When the type-of-farm classes are further subdivided in accordance with the standard assessed values (*Einheitswert*) there is no improvement in the correlation between size of farm and magnitude of gross cash farm receipts. Weber concludes that, for German agriculture, management plays a much more important role

than size of farm or type of farm in determining the pattern of income distribution. The policy implication of this segment of her analysis lies in the fact that an attempt to alleviate existing income disparities within any given West German type of farming area, or size-of-farm class, would require an exceptionally complex combination of differentiated price, transportation, finance and tax policies.

There follows an effort to develop a picture of the distribution of incomes in German agriculture by magnitude of cash income and size of farm. For this purpose the 1950-51 farm bookkeeping records for 4,173 farms of 5 to 10 hectares (12.5 to 247 acres) were taken as a base. From this base Weber constructs a synthetic picture of the scatter of 1950-51 cash farm incomes for the 780,569 West German farms of 5 to 100 hectares.

From these estimates she concludes that some 20 per cent of the households received more than 7,500 DM per year and accounted for 45 per cent of total income from the 5 to 100 hectare farms. The unrepresentativeness of an "average farm income" figure is underlined by the fact that, although the average income for all farms was 5,040 DM per year, those units receiving more than 5,000 DM per year included 47 per cent of all farms and received 74 per cent of total income.

When these data are corrected for home consumption and the rental value of the farm dwelling, the income distribution is less extreme. Valuing these perquisites at 2,500 DM per year leads to the conclusion that 43 per cent of all households received more than 7,500 DM per year, or 64 per cent of total income in 1950-51.

Weber concludes that, for West German farms of more than 5 hectares, the agricultural income distribution pattern is relatively favorable. In arriving at this conclusion she relies on the index of income inequality developed by C. Bresciani-Turroni.[3] Her data seem to support his conclusion that the income distribution pattern of agrarian regions tends to be less one sided than in the nonagricultural sectors.

On this point, recent American experience suggests some caution. Income in a peasant agriculture may be more evenly distributed among its recipients than is the case in the industrial and urban occupations of the same economy. As agriculture becomes more commercial and technical, this balance may shift. The bookkeeping records of Midwest United States farms in the past 20 years trace a sharply increasing disparity in farm income distribution. In the industrial sector of the American

---

[3] "Pareto's Law and the Index of Inequality of Incomes," *Econometrica*, Vol. 7, No. 2, April 1939, pp. 117-133. See also C. Bresciani-Turroni, *Economic Policy for the Thinking Man*, London: William Hodge and Co., 1950, pp. 280-81 and the Appendix to Chap. XIV.

economy, wages and salaries have increased sharply in the lower brackets, and progressive income tax rates have eaten heavily into upper-bracket incomes. It may well be that the disparity in income distribution net after direct taxes in American agriculture now exceeds that found in many of our major nonagricultural sectors. It is certain that the trends of the past two decades have been working in this direction.

In the final section of the monograph, Weber presents historical data to show the stability of total income distribution over time. For the United States and Germany she concludes that the pattern of total income distribution has been remarkably stable for the past 50 to 75 years. Bresciani-Turroni found in Prussia, for example, that the top 12 per cent of all income recipients received 38 per cent of total income in 1875; in 1928 the top 11 per cent also received 38 per cent of total income. For the United States her data indicate that the top 10 per cent received 34 per cent of the income in 1910; 32 per cent in 1948.

The stability of these relations is impressive, in the face of massive changes in levels of incomes and in social and technological conditions. Although these patterns of income distribution seem exceptionally durable, still the occupational composition of income classes does change. Whether or not agriculture is gaining or losing ground in this process is still unclear. The evidence that is available is not comforting to agriculture.

These inferences invite speculation as to the future patterns of income distribution and inequality in the agricultural and nonagricultural sectors of developed and underdeveloped economies. Weber's evidence and argument point up the great advantage possessed by the industrialized over the agricultural sectors and countries in the dynamics of income growth. "The further behind countries are in economic development and the lower therefore their income is, the longer it will require until they reach the status which the further advanced countries have today." (p. 93)

The evil genie behind this judgment Weber finds primarily in the progressively declining income elasticity of demand for agricultural products. If agricultural producers are to enjoy the fruits of technical progress they must couple an increasing physical output with a much greater proportional reduction in productive effort than is required for producers of goods with elastic demands. Here Weber's conclusion is sharply focused: "No factors are discernable that will enable agriculture to achieve a proportional improvement of its income over and above the normal rate of growth. On the contrary the agricultural policy of most countries has thus far been unable to prevent the real income of the lower classes of the agricultural income pyramid from remaining behind the growth of other income classes." (p. 96)

Marketing and trade policies may aid in the adjustment of a well balanced and structurally sound agriculture to the condition of modern economic growth. The conclusion seems none the less inescapable that the particularly low incomes in many agricultural areas are primarily due to structural defects. Where these prevail, only radical changes in ownership and property conditions will alter the pattern of income distribution. Marketing and price policies are ineffective tools for this task.

In closing, Weber again points to the inadequacy of parity price and related proposals for the betterment of German agricultural conditions. "The area in which income can be significantly influenced through price policy," she points out, "is much smaller than is generally assumed." (p. 98)

The analysis developed in this monograph is particularly pertinent to the recent conflicting arguments over income disparities in developed and underdeveloped countries. Using data from Ceylon, Puerto Rico, the United States and the United Kingdom, Theodore Morgan has argued that income distribution in underdeveloped countries is more unequal than in developed economies.[4] This view has been repeated and amplified by Simon Kuznets in his 1954 Presidential address to the American Economic Association.[5] Of greater significance is the fact that the trends of recent years seem to have reduced income inequalities in developed countries, and increased them in the underdeveloped and semideveloped areas. Although the statistical evidence supporting this view leaves much to be desired, Kuznets feels that the weight of the data falls in this direction.

The discussion thus far has been in terms of "developed" and "underdeveloped" countries. With some well marked exceptions, the reasoning can be rephrased in terms of "agricultural" and "industrialized" economies. If the argument is solid on an international scale, what is its validity on an intersectoral scale? How have the disparities in income distribution varied in recent years as between the agricultural and nonagricultural spheres of given countries?

On this point Weber offers additional data. In a recently published supplement to her basic monograph she has repeated the analysis of income distribution in German agriculture for the year 1953-54.[6] One of

[4] "Distribution of Income in Ceylon, Puerto Rico, the United States and the United Kingdom," *Economic Journal*, Vol. LXIII, No. 252, Dec., 1953, pp. 821-34. For a contrary view, and Morgan's rejoinder, see Harry T. Oshima, "A Note on Income Distribution in Developed and Underdeveloped Countries," *Economic Journal*, Vol. XLVI, No. 261, March 1956, pp. 156-160.

[5] "Economic Growth and Income Inequality," *American Economic Review*, Vol. XLV, No. 1, March 1955.

[6] "Entwicklungstendenzen des landwirtschaftlichen Einkommens 1950/51 bis 1953/54," *Berichte ueber Landwirtschaft*, N.F. XXXIV, 1956, No. 1, pp. 11-24.

the surprising findings is that total cash income in 1953-54 was virtually the same as in 1950-51. Over the same years the level of income in the nonagricultural sector had advanced sharply. (West German industrial wages, for example, were about 25 per cent higher in 1953-54 than in 1950-51.) As a consequence, that segment of German agriculture generally assumed to represent the full-time peasant-type units (5 to 100 hectares) seems clearly to have lost ground relative to the industrial sector since 1950.

The disparity in agricultural incomes also widened. The percentage of farms reporting losses almost doubled, while the percentage of those reporting top-level incomes significantly increased. When grouped by types of farms, the income distribution was also greater. The income advantage of sugar-beet producers, which was substantial in 1950-51, had markedly improved by 1953-54. A similar but less pronounced improvement in income position was reported for grain farms. On the other hand, farms concentrating on fodder and forage production had lower incomes in 1953-54, and particularly those in the smaller size-classes (less than 40 hectares of agriculturally used land).

These trends take on added interest in view of the historical German policy of protection for grain and cash-crop producers. Weber's data indicate that the farms concentrating on fodder and forage production, and hence dependent on livestock product markets for their ultimate cash incomes, have not maintained their income position in recent years relative to grain and sugar-beet producers. These observations invite the tentative generalization that German agricultural policies from 1950 to 1954 seem to have favored cash crops more than animal agriculture.

When farms were grouped in accordance with levels of productivity, the same tendency toward increasing disparity was noted. In the *Einheitswert* (standard assessed value) class of 2,000-2,200 DM per hectare, the income position of the small farms was worse in 1953-54 than in 1950-51, while the income position of the farms of 50 hectares (125 acres) and over had improved.

Weber's data thus indicate that in West German agriculture between 1950-51 and 1953-54 the disparities in income distribution increased (a) as among types of farms (b) as among size of farms within the same type, and (c) as among size of farms within the same productivity class.

These data are for a single country, and for a short but important time period. Although the statistical base is weak, the failure of global agricultural income to keep pace with industrial wages points toward a recent widening in the pattern of German income distribution between

---

The analysis is based, as before, on the generalized results of some 4,000 bookkeeping farms in the 5-100 hectare size class.

the agricultural and nonagricultural sectors. This has been associated with a parallel widening spread in the distribution of income within agriculture itself.

Kuznets, Morgan, and others have advanced the hypothesis that income distributions tend to be more unequal in underdeveloped than in developed economies, and that in underdeveloped countries the tendency has been toward increasing disparities in recent years. Weber's study invites the extension of this hypothesis to cover the relations between the "underdeveloped" (agricultural) and "developed" (nonagricultural) sectors *within* countries.

If subsequent investigations support this view, it may represent a long step toward an understanding of the basal importance of structural deficiencies in the organizations of agricultural countries and sectors, and of the limited effectiveness of price and marketing policy in combating their agricultural problems. Viewed in this light, Weber has produced a challenging and seminal work.

GALBRAITH'S STINGER

BUSHROD W. ALLIN
Agricultural Marketing Service

IN HIS review of Murray Benedict's book in the August issue of the *Journal of Farm Economics,* Galbraith practically pronounced the benediction for agricultural economics. He is eternally right in his main thesis that championship of free-price doctrine as the dominant philosophy among the leaders of agricultural economics when they discuss agricultural policy has done much to lead the discipline to the brink of futility. As he puts it, "the once-influential profession of agricultural economics" has been "reduced to the role of neglected scolds. . . ."

As a Harvard man, however, Galbraith is too scholarly not to realize that there are many agricultural economists who are thinking and acting to find a better way to solve the farm problem. The history of agricultural economics and agricultural economists reveals their ambivalence. Agricultural economists very frequently are found *theorizing* one way while *acting* another. If agricultural economics is dead, agricultural economists are not; and many of the latter (including Galbraith) are doing real service in helping farm leaders find a workable and satisfactory solution to their problem.

Most of the bulletins and books dealing with agricultural policy tend to approach one of two extremes—that is, they are either historical in nature or, at the other pole, actual polemics of particular individuals who have been unable to sell their viewpoint. During the 1920's success

and influence in the agricultural economics field depended for the most part upon publications. With the introduction of the action era, however, starting with Henry C. Taylor and receiving enormous multiplication in the 1930's forward, it has been the ability to mix in the "give and take" of arguing issues, writing legislation, and administering programs where influence has most often been brought to bear.

Modern farm policy began at the end of World War I when Henry C. Wallace went about the country saying that the farmers' problem was an economic problem—not a production problem. That being so, what was more logical than for him to call upon a Department of Agriculture economist to help solve the problem? For that task he selected Henry C. Taylor. Now, it so happened that Taylor was more than an economist, he was also a red-headed, practical man of action. His economics really interfered with his action, but not enough to prevent action.

Being a university economist, he was only performing in accordance with his habitual assumptions when he came to Washington and established a Bureau of Agricultural Economics (now extinct), modeled somewhat after his Department of Agricultural Economics at Wisconsin—but at once there was more action.

Having set up his Bureau, he was still faced with the problem of what action he should take. In the political and economic climate of that day the only feasible action he could figure out was an outlook service—a service that has continued to this day in a vigorous and useful form.

But this was not enough, and Taylor knew it. Officially, he gave aid and comfort to the McNary-Haugenites who wanted to achieve "Equality for Agriculture" by "making the tariff effective for agriculture." Partly for this activity he got fired. *But never once did he endorse the plan in professional economic journals or make public pronouncements in its favor.* His motto was, "Thought without action, theory without practice is sterile; and action without the benefit of research, thought and theory is movement in the dark."

Because his Bureau was intermittently called upon to make analyses to provide a basis for action, its lasting and continuing service was its influence in giving research men the will to action by modifying their college-bred laissez-faire assumptions. These men can be found in influential and strategic positions throughout the government, in farm organizations, and in private enterprise. Some of them have even gone back to the universities where they are teaching men to think about action as well as justification for inaction.

A NOTE ON DEMAND ELASTICITY, PRICES, AND THE BUSINESS CYCLE

LAWRENCE E. FOURAKER
Pennsylvania State University

LET P_i be the index of prices in the inelastic range of their respective demand curves. Let P_e be the index of prices in the elastic range of their demand curves. Let R represent the ratio P_i/P_e. The hypothesis will be developed that variation in R will cause shifts in the consumption function, and therefore in aggregate economic activity.

Assume that the typical consumer orders his wants in such a manner that a lower ranked want is not considered until some quantity of higher ranked goods has been purchased. Interspersed in the hierarchy will be various forms of savings, such as insurance, securities, or savings accounts. If there is a relative increase in P_i, or a relative decrease in P_e, the consumer will increase his expenditure on the item whose price had changed. This will reduce the amount of income allocated to lower ranked items, presumably including some forms of savings. Thus there will be a reduction in the amount of saving out of given levels of income. An increase in R will increase the consumption function.

Conversely, a relative fall in P_i or rise in P_e will reduce the amount of expenditure on the item whose price had changed. An increased amount of income will be allocated to lower ranked items, including some forms of savings. There will be an increase in savings out of given levels of income. A fall in R results in a reduction in the consumption function.

Our argument is that the ultimate cross elasticity between the quantity of savings and the price of a commodity will be positive if that price is in the elastic range of its demand curve, and negative if the price is in the inelastic range. Thus price changes, if they are not over an arc with elasticity of unity, will alter the amount of savings out of given levels of income, or the consumption function. Such shifts in the consumption function will influence aggregate economic activity in the same direction as the shift.

It is difficult to test the hypothesis that changes in R contribute to the instability of aggregate economic activity, for R would be a trying variable to measure. Ideally, elasticities should be calculated for all prices, so that they could be classified under the headings P_e and P_i. Estimates of P_e and P_i could be made by some weighted average technique, and a reliable measure of R could be calculated. Since this program was beyond the means of the author, some rougher approximation of R was sought. It was assumed that the parity ratio would serve this purpose. Certainly all the indications are that the prices farmers receive are in the inelastic

portion of consumer's demand curves, and it seems likely that the prices farmers pay are in the elastic range of their respective demand curves.[1] The measure of economic activity was the Federal Reserve's index of industrial production. The data analyzed consisted of 107 monthly observations over the period from December 1945 through October 1954. Both series were adjusted for seasonal and trend during this period. Three coefficients of correlation were calculated. The first was with no lag and equaled .416. The second was with the index of industrial production lagged one month behind the parity price index, and equaled .442. The third was with the index of industrial production lagged two months, and equaled .423.[2] Since the correlation was highest for the one month lagged series it is not illogical to suppose that what causative effect existed, if any, operated from the price changes to the changes in industrial production.[3]

It is not suggested that these relationships are an important force in the business cycle. Changes in autonomous investment and other exogenous variables dwarf them to the verge of insignificance. However, the influence of such major forces is matched by their unpredictability. The economist must look for relationships that are measurable and predictable, even if they are minor. Perhaps the amassing of a great number of such relationships would by-pass the difficulties associated with the major variables and yield reliable predictions in the aggregate.[4] With a more exacting classification of prices the above analysis might make a small contribution in that direction.

---

[1] H. Schultz, *The Theory and Measurement of Demand*, The University of Chicago Press, p. 556.

[2] The coefficients would have been larger if the data for 1952 had been omitted. The steel strike of that year lowered the adjusted production index to mid 1959 levels while the adjusted parity ratio was rising to a peak that has not been approached since then. Thus the two series had a sizeable negative correlation for that unusual year.

[3] The F ratio was 25.4, which is significant at the one per cent level. However, it is doubtful if the F test is appropriate, since the observations are not independent of one another. It is conceivable that identification and autocorrelation techniques might clarify the nature of the relationship, but they are beyond the scope of this note.

[4] A. F. Burns, *The Frontiers of Economic Knowledge*, The Princeton University Press, p. 131. G. H. Moore, "Analysing Business Cycles," *The American Statistician*, April-May, 1954, *passim*.

COMPUTATION OF THE R COLUMN OF THE SIMPLEX LINEAR PROGRAMMING WORKSHEET

HORACE L. PUTERBAUGH
Purdue University

A RECENT note[1] in this *Journal* regarding the use of the simplex worksheet for linear programming requires clarification. In this note the authors state that negative values may be computed in the R column and that the *smallest absolute value* is the selection criterion. This is incorrect.

In this column (R) ratios of the values in the P_o column (the column which, in the first tableau, contains the quantities of the limiting factors) over the corresponding value in the column containing the most negative Z-C value are computed. *Only positive values are used for the denominators in computing these ratios.* Thus, only positive ratios ever appear in the R column when these ratios are computed using the P_o column, and a negative figure cannot appear in the P_o column of the next matrix. (Processes can only be operated at positive levels, therefore, entries in the P_o are required to be positive.)

In special cases of "ties" among the smallest ratios in the R column (degeneracy), columns to the right of the P_o are used for the numerator of the ratios used to break this tie. In this case an R' column appears, containing as many ratios as there were tied ratios in the R column. These R' ratios are computed without restriction on the sign of the numerator. The same denominators are used for the R' column as were used for the R column. Therefore, a negative R' ratio can appear to break a tie. The smallest (algebraic) ratio is used to determine which row is to be replaced in the next matrix. The next matrix cannot have a negative figure in the P_o column, *even though a negative ratio appeared in the R' column,* since the reduction of the possible choices by the R column eliminated this possibility.

The general rule is, therefore, one that allows no negative ratios to be computed for the R column but permits negative ratios to be computed for the R' column to break a tie. In the R column the sign of the ratio is of no significance since only positive values can be computed, but in the R' column negative values can appear and the smallest (algebraic) ratio is the selection criterion. R" columns and etc., can appear to break ties occurring in the ratio column preceding. Here again, the smallest (algebraic) ratio is the selection criterion.[2]

---

[1] J. L. Dillion and G. C. McFarlane, "Using the Simplex Worksheet for Linear Programming," *Journal of Farm Economics*, May 1956, pp. 622 and 623.

[2] This procedure is discussed fully in "An Introduction to Linear Programming," by A. Charnes, W. W. Cooper, and A. Henderson.

BOOKS RECEIVED

Ahlgren, Gilbert H., "Forage Crops" (Second Edition), New York: McGraw-Hill Book Co., Inc., 1956. Pp. viii, 536. $7.00.

Blodgett, Ralph H. and Donald L. Kemmerer, "Comparative Economic Development," New York: McGraw-Hill Book Co., Inc., 1956. Pp. x, 557. $6.00.

Brown, Robert H., "Farm Electrification," New York: McGraw-Hill Book Co., Inc., 1956. Pp. viii, 367. $7.00.

Eckles, Clarence H. and Ernest L. Anthony, "Dairy Cattle and Milk Production," New York: The Macmillan Co., 1956. Pp. xix, 587. $6.00.

Golding, E. W., "The Generation of Electricity by Windpower," New York: Philosophical Library, 1956. Pp. xvi, 318. $12.00.

Greenhut, Melvin L., "Plant Location in Theory and in Practise," Chapel Hill: University of North Carolina Press, 1956. Pp. ix, 338. $7.50.

Häfner, K. and G. Thiede (Editors), "Statistisches Handbuch—Landwirtschaft und Ernährung," Hamburg: Paul Parey for the Bundesministerium für Ernährung Landwirtschaft und Forsten, 1956. Pp. 230. (No price listed.)

Harris, Marshall and Joseph Ackerman, "Town and Country Churches and Family Farming," New York: Dept. of Town and Country Church, National Council of Churches of Christ in the U.S.A., 1956. Pp. x, 102. $1.50.

Hickman, C. Addison and Manford H. Kuhn, "Individuals, Groups, and Economic Behavior," New York: The Dryden Press, 1956. Pp. xvii, 266. $4.75.

Knauth, Oswald, "Business Practices, Trade Position, and Competition," New York: Columbia University Press, 1956. Pp. 177. $3.00.

Lloyd, E. M. H., "Food and Inflation in the Middle East 1940-45," Stanford: Stanford University Press for The Food Research Institute, 1956. Pp. xiv, 375. $6.00.

Maynard, Leonard A. and John K. Loosli, "Animal Nutrition," New York: McGraw-Hill Book Co., Inc., 1956. Pp. vii, 484. $7.50.

Sennholz, Hans F., "How Can Europe Survive," New York: D. Van Nostrand Co., Inc., 1955. Pp. iv, 336. $5.00.

Sennholz, Mary (Editor), "On Freedom and Free Enterprise," Princeton: D. Van Nostrand Co., Inc., 1956. Pp. xiv, 333. $3.50.

Special Policy Committee on Technical Cooperation, "Technical Cooperation in Latin America," Washington: National Planning Association, 1956. Pp. xii, 192. $2.50.

Wilcox, Walter W., "Social Responsibility in Farm Leadership," New York: Harper and Brothers, 1956. Pp. xi, 194. $3.00.

"Yearbook of Food and Agricultural Statistics 1955," Rome: Food and

Agriculture Organization of the United Nations, 1956. Pp. xi, 427. (No price listed.)

BULLETINS RECEIVED

Berry, C. H., E. O. Anderson, D. J. Baker, G. K. Brinegar, L. R. Dowd, and Stewart Johnson, "The Demand for Fluid Skim Milk," Storrs Connecticut Agr. Expt. Sta., Bul. 325, May 1956.

Bertrand, A. L., J. L. Charlton, H. A. Pedersen, R. L. Skrabanek, and J. D. Tarver, "Factors Associated with Agricultural Mechanization in the Southwest Region," Arkansas Agr. Expt. Sta., Bul. 567 (Southwestern Regional Bul. No. 6), February 1956.

Cook, Hugh L., Harlow W. Halvorson and R. Wayne Robinson, "Costs and Efficiency of Wholesale Milk Distribution in Milwaukee," Wis. Agr. Expt. Sta., Research Bul. 196, June 1956.

Farmer Cooperative Service, "Farmer Cooperatives in the United States," U.S.D.A., FCS Bul. 1, December 1955.

Morrison, T. C., G. G. Judge, and E. H. Tompkins, "Impact of Price Expectations and Uncertainties on Decision Making by Poultry Firms," Storrs Connecticut Agr. Expt. Sta., Bul. 320, September 1955.

Weber, Peter Dale, "Wisconsin Maple Products—Production and Marketing," Wis. State Dept. of Agriculture, Bul. No. 335, June 1956.

MISCELLANEOUS PUBLICATIONS RECEIVED

"A Look at Foreign Trade for the Wisconsin Dairyman," Hugh L. Cook and Glynn McBride, Wis. Agr. Econ. Series No. 17, April 1956.

"A Study of Regulatory Provisions of Milk Ordinances and Their Administration in Selected Wisconsin Communities," Robert Sucher and Hugh L. Cook, Wis. Agr. Econ. Series No. 19, August 1956.

"Agrarian Reform in Communist China to 1952," Shao-er Ong, chief contributor; research accomplished under contract with Human Resources Research Institute, Maxwell Air Force Base, Alabama, Res. Memorandum No. 41. Pub. by Air Force Personnel and Training Research Center, Lackland Air Force Base, Texas, July 1955.

"Agricultural Price and Cost Projections," ARS and AMS, U.S.D.A., June 1956.

"Annual Report 1955," The Twentieth Century Fund, New York, 1956.

"Basic Research and the Analysis of Current Business Conditions," National Bureau of Economic Research, Inc., Thirty-sixth Annual Report, May 1956.

"Chinese Farm Economy after Agrarian Reform," Shao-er Ong, chief contributor; research accomplished under contract with Human Resources Research Institute, Maxwell Air Force Base, Alabama, Tech.

Res. Report No. 34. Pub. by Air Force Personnel and Training Research Center, Lackland Air Force Base, Texas, August 1955.

"Cooperative Dairy Associations in Washington," Laszlo Valko, Washington Stations Cir. 287, July 1956.

"Cooperative Grain and Dry Pea Marketing Associations in Washington," Laszlo Valko, Washington Stations Cir. 237, December 1953.

"Educational Exchanges—Aspects of the American Experience," Report of a Conference Sponsored by the Committee on International Exchange of Persons of the Conference Board of Associated Research Councils. National Academy of Sciences—National Research Council, Washington, D.C., 1956.

"Farm Costs and Returns, 1955 (with Comparisons)—Commercial Family-Operated Farms by Type and Location," Agr. Res. Service, U.S.D.A., Agr. Inf. Bul. No. 158, June 1956.

"Fertilizers—Production, Consumption, Prices, and Trade in European Countries 1953-56," OEEC, Paris. Available at OEEC Pub. Off., Washington. April 1956, $1.25.

"Governmental Cost in Agriculture—The Concept and Its Measurement," Frederick D. Stocker, U.S.D.A., ARS 43-28, May 1956.

"How Good Is the 18 Condensery Pay Price?" Hugh L. Cook, Prepared on behalf of Eastern Milk Producers Cooperative Association, Inc., Syracuse, N.Y., May 1956.

"Outlook for Nevada Agriculture," Nevada Dept. of Agr. Econ. Series No. 2, June 1956.

"Population Changes Among Rural Negroes in Mississippi," B. W. Harris, Alcorn A. and M. College, Lorman, Miss., June 1956.

"Profitable Roadside Marketing," R. B. Donaldson and Wm. F. Johnstone, College Science Publishers, State College, Pa.

"Review of the Co-operative Movement in India 1952-54," Reserve Bank of India, Agr. Credit Dept., Bombay, March 1956. Rs. 3.

"Rural Education," Royal Commission on Agriculture and Rural Life, Report No. 6, Queen's Printer, Regina, Sask., 1956. $1.00.

"The Farm Economist," Vol. VIII. No. 4, 1955, The Agricultural Economics Research Institute, Parks Road, Oxford. 10s. a year or 2s. 6d. a copy.

"The Florida Chrysanthemum Industry," Cecil N. Smith and Donald L. Brooke, Florida Agr. Econ. Mimeo. Report 56-10, May 1956.

"The Geography, Birds, and Mammals of the Perry River Region," H. C. Hanson, Paul Queneau, and Peter Scott, The Arctic Institute of North America, Montreal, Spec. Pub. No. 3, February 1956. $2.00 to nonmembers, $1.00 to members.

"Ways to Increase Use of Milk in Wisconsin Schools," Hugh L. Cook and Hugh L. Moore, Wisconsin Ag. Econ. Series No. 16, March 1956.

REVIEWS

United States Agriculture: Perspectives and Prospects, William H. Nicholls, Technical Director. The American Assembly, Graduate School of Business, Columbia University, New York, N.Y. Participants' Edition, 1955. Pp. 124.

This volume is the work of a select group of competent agricultural economists and social scientists under the guidance of William H. Nicholls who served as Technical Director of the Seventh American Assembly. The report contains the background papers prepared for the use of participants in the Seventh American Assembly held at Columbia University in May 1955.

What is the American Assembly? It is a national nonpartisan program of continuing conferences established in 1950 by Dwight D. Eisenhower, while President of Columbia University. The program brings together individuals representing business, labor, agriculture, the professions, both political parties, and government. The stated aim of the Assembly is to throw impartial light on the major problems facing America so that our citizens can take effective steps toward their solution.

The contents of the present report therefore comprise an advance symposium which served as a central core for the discussions held at the Assembly proper. Although the volume is not a tightly organized and integrated study, it still has sufficient unity to bring into focus the main problems of *United States Agriculture* as seen from several different and independent expert vantage points.

In pursuit of the essential structural unity, the volume opens with an introduction by Technical Director Nicholls in the form of a "travel-guide" which explains briefly where agriculture has traveled and points out some of the alternative roads for future journeys.

Nine papers make up the body of the volume:

1. "The American Farmer in a Changing World," by Walter W. Wilcox.
2. "Agriculture's Technological Revolution," by Glenn L. Johnson.
3. "The Role of Farm Prices in Agricultural Production," by D. Gale Johnson.
4. "Farm Price and Income Instability," by Harold G. Halcrow.
5. "Surplus Disposal and Domestic Market Expansion," by Geoffrey S. Shepherd.
6. "American Agriculture and Foreign Economic Policy," by O. B. Jesness.
7. "The Low-Income Problem in American Agriculture," by W. E. Hendrix.
8. "Improving Rural Community Services," by Wayland J. Hayes.

9. "Conservation of Agricultural Resources," by Raymond J. Penn and C. W. Loomer.

Each author concludes his contribution with a list of specific issues that he considers significant for the next decade or more. Wilcox, for example, sums up his review in his belief that the central issue in the years ahead will not be price stabilization, but "how can farmers share more fully in the economic growth of the economy as a whole?"

Glenn Johnson's clear marshalling of well-known materials on trends in farm technology points up the dilemma inherent in rapid technological progress and lagging transfers of resources between agriculture and the rest of the economy.

D. Gale Johnson's careful review of the history of price supports and alternative policies in this area lead to his final observation that the major issue is what objectives should be served by price policy.

Closely related is Halcrow's excellent coverage of the problems of price and income stability—so different in agriculture from those in industry. He too concludes that key questions are those of objectives or goals. How much stability, for what part of agriculture, and in terms of what relative costs and benefits?

Shepherd's discussion of surplus disposal naturally emphasizes the demand side. But he also forthrightly points out the basic need for encouraging the movement of excess boys and girls out of agriculture into better paying urban occupations.

The well-balanced if sometimes cautious analysis of foreign trade by O. B. Jesness deserves to be read by every thoughtful student of the subject. He sees the need for a careful reappraisal of trade policy. His final "questions for discussion" bear the imprint of the university class room. What graduate student in economics would not writhe under the innocent question, "Why are foreign markets important for agriculture?"

The low-income farm problem is ably described by Hendrix as a neglected area of great magnitude in terms of human values. Without visualizing any panacea, he suggests a more positive approach in terms of expanding nonfarm job opportunities and of helping those remaining in agriculture to adjust along new lines.

Improving rural community services are summarized by Wayland J. Hayes in terms of educational facilities, public libraries, agricultural extension, health services, and similar tangible and intangible items.

"Conservation" is a word of many meanings, say Penn and Loomer of Wisconsin. Their discussion reviews the differences in concepts and examines alternative lines of action. They point out the basic problem faced in striking a balance between present and future needs.

What is the direction of the whole report? Clearly it is forward looking

from a solid base of past experience. One may question whether or not a large enough proportion of the total space was allocated to alternative lines of future policy. But surely the volume is an excellent introduction to a gathering like the American Assembly.

RONALD L. MICHELL

Agricultural Research Service

Social Responsibility in Farm Leadership, Walter W. Wilcox, New York: Harper and Bros., 1956. Pp. xi, 188. $3.00.

A great deal has been written about the social responsibilities of businessmen and labor leaders, but very little about the responsibilities of farm leaders to society as a whole. This new book, one in a series on Christian ethics and economic life sponsored by the National Council of Churches, is therefore a welcome contribution to the literature of agricultural economics, political science and public affairs in general.

Dr. Wilcox is exceptionally well qualified to deal with the subject of social responsibility in farm leadership. He has had long experience in the federal government, including work with the agricultural committees in congress as a staff member of the legislative reference service of the Library of Congress. He also served on the faculties of two state colleges of agriculture. In preparation for writing a chapter in this book on The Process of State Farm Leadership, Wilcox interviewed a large number of farm organization leaders. Attitudes expressed by these farm group executives furnish valuable insights into the functioning of their organizations.

Farm leaders, like the leaders of other pressure groups, usually are single-minded individuals. They display a rather high order of selfless devotion to their own organizations, which is how they get to be leaders. They promote the interests of their own group with little concern for the consequences to other groups. But they do have to *recognize* other interests and to make compromises. Farmers and farmers' organizations wield political influence in the United States far greater in proportion to their numbers than other groups. This is partly a matter of tradition and partly because legislative redistricting lags so far behind population changes. The extraordinary bargaining power of farm leaders in both congress and state legislatures thus places a special burden of social responsibility on these leaders.

Moral philosophy always has been a paramount theme in the speeches of farm leaders and the resolutions of farm organizations. The present Secretary of Agriculture, like the first New Deal Secretary, Henry A. Wallace, flavors his public statements with many religious references and ethical connotations. When he assumed office he said the supreme test of

any government policy should be, "How will it affect the character, morals and well-being of our people?"

The author of this book observes that Christian ethics do not point to a single economic philosophy. He thus disposes of the implied argument that "God is on my side" as a test of meeting social responsibility.

Wilcox assumes, rightly I think, that equality, primarily equality of opportunity, is one of the chief goals of the American society. Farm leaders have a responsibility to their members and to the general public to see that power is not used selfishly to the disadvantage of certain groups.

Some of the most serious instances of inequality of opportunity and inequality of bargaining power occur within agriculture itself. Wilcox points out that farm leaders, while generally concerned about inequality as between agriculture and the rest of the economy, have paid little attention to the same problem within agriculture. None of the major farm organizations has taken an active part in efforts to improve social and economic conditions for hired farm workers. Neither have these organizations sought vigorously to improve the lot of the so-called "low income farmers," the noncommercial third of agriculture.

The author raises the question, "Whether farm organizations, made up primarily of family type farmers, have a social responsibility with respect to the low income rural groups." Then he asks, "If the responsibility of organized groups is limited to their membership, who in our democracy should assume responsibility for the unorganized groups?"

Wilcox notes that "each of the three [general] farm organizations indicated a concern for the low-income or underemployed farm families in their 1955 resolutions and legislative programs. This was the first time, however, that the low-income or underemployment problem in agriculture was mentioned specifically in the resolutions of the American Farm Bureau or the legislative program of the National Grange. . . . One is impressed with the time lag which has existed between the discovery and analysis of a problem situation such as this and the development of a socially acceptable action program to correct it."

The Farmers Union, in contrast to the Farm Bureau and the Grange, consistently supported government activities such as those of the Farm Security (Farmers Home) Administration, designed to aid low-income farmers, and has consistently lobbied for increased funds for helping underprivileged farm people.

The author explains the differing approaches of the major farm organizations to public policy in the light of their history, geography and membership. He does not draw sweeping conclusions about which organizations are living up to their social responsibilities and which are

not. He has maintained a scholarly objectivity in describing the varying viewpoints and the "why" of them.

An appendix by Charles H. Seaver discusses the farmer co-operative movement and the ethical motivations behind it. Mr. Seaver expresses mild concern that the democratic philosophy which pervaded the co-op movement from the beginning can be maintained in the larger and widerspread organizations of today. He believes that co-op leaders, "though deeply involved in the structure of modern business," cannot ignore their social and ethical responsibilities.

LAUREN K. SOTH

Des Moines Register and Tribune

An International Economy, Gunnar Myrdal, New York: Harper & Brothers, 1956. Pp. xi, 381. $6.50.

Economists and administrators will be moved by the challenge of this book for decades to come. The author has been professor of economics, student of U.S. race relations, senator and cabinet member in Sweden, and high-level international official (Economic Commission for Europe)–all with extraordinary distinction. With an amazing sureness of touch, he points a forward path through all the events, policies and theories behind current international economic relations.

As ultimate goal, he takes economic integration in the non-Soviet world. Integration is defined as the economic condition desired by a free society (equality of economic opportunity), not as the product of a particular economic model.

He finds a drift toward *dis*integration. The advanced Western industrial countries have been achieving *internal* integration at the expense of their pre-1914 *international* integration. Economic exchanges, especially of factors of production, are breaking down. The poor, largely non-white majority of mankind did not share in the advantages of pre-1914 industrialization and its income levels are still falling by comparison with the advanced countries. The alternative for the West is to take the lead toward integration that its ideals dictate and thereby achieve a respected, albeit minority, position in a democratic world society or to see widespread political upheaval. For the underdeveloped countries, the problem is to integrate themselves internally against enormous odds–with or without Western help–in order to obtain bargaining power in the international community and avoid cataclysm. A number of current steps are in the right direction, especially in the U.S., but they are grossly inadequate. They serve as "conscience money" to avoid facing the full problem.

This summary hardly suggests the range of important and challenging conclusions. Myrdal sees the world whole. He avoids the pitfalls in com-

partmentalized discussion by constantly bringing in relevant conclusions from other compartments. The result is a series of fresh insights that richly reward a close study of the text. One may not agree with every proposition (Myrdal considers many of them just guides to further research), but all are interesting. I find it difficult to select for this short review.

1. Human solidarity is a necessary condition for economic integration. The groups who came out on top in early economic development in the advanced countries did not at first accept sacrifice on behalf of their less favored compatriots. National solidarity had to be built up in crises (depression and war) before modern welfare institutions (progressive taxation, labor mediation, credit control, income support programs, etc.) could successfully intervene for "redistributional" purposes. This solidarity is not extended to foreigners except as charity, even in times of great economic progress. Myrdal hopes that such solidarity will develop gradually through working together in international institutions, especially those (which he recommends greatly expanding) for research cooperation to adapt technical knowledge to local underdeveloped-country problems. He prays that liberals and social scientists in the Western countries (in danger of enervation through success at home and the ideological pressures of the cold war) will dedicate themselves to the enormous task of changing attitudes toward human solidarity. (He does not specifically point out that international solidarity might, as national, develop out of crisis—a huddling together for security—as, perhaps, from the fear of using nuclear weapons.)

2. International integration is not to be achieved by abandoning nationalistic welfare policies that conflict. (One thinks of the famous "conflict" between agricultural supports and international trade policy.) The route must be through international coordination and mutual adjustment of national policies to serve common interests, while protecting the national groups whose incomes they support.

3. The coordination of agricultural programs through international commodity arrangements or world food schemes could save underdeveloped countries from (to them) disastrous price fluctuations for their exports. Myrdal sees little present hope from this quarter and notes that the underdeveloped countries may feel forced to seek long-term bilaterals. (This may prove pessimistic. Cut-throat competition is usually limited, at the eleventh hour, by some sort of international understanding.)

4. Western governments and economists misapply classical trade theory. Advanced countries should continue to try to liberalize trade and achieve convertibility, but this cannot accomplish integration. Even under the theory of comparative costs, it would decrease (not equalize)

factor-price differentials, assuming complete internal factor mobility (unrealistic) and no international mobility (now realistic). (Factor mobility was a force in pre-1914 international integration and in U.S. internal integration.) The theory is entirely unrealistic as between an advanced and an underdeveloped country because relative money costs are grossly distorted. Free trade may even cause factor-price differentials to widen to the disadvantage of the underdeveloped country.

5. As no other man, Myrdal can translate into the idiom of the disciplined social scientist the problems, possibilities, and proud compulsions of underprivileged peoples. The underdeveloped countries have been "awakened" by Western ideas and ideals. Myrdal makes shockingly clear how much more difficult is their development task of today than that of the West in the 1900's. By his premises, he rules out resort to the harsh Soviet technique. He admits the probability of failure, but reserves judgment because of "the faith and devotion of their intellectual and political leaders." (He may think of an earlier "Awakening" which produced such men as Tom Paine and Ben Franklin.)

And so on: Why Western European integration has failed under extraordinarily favorable circumstances, why underdeveloped countries associate the Soviet system with development and ours with its suppression, why the United States (alone among advanced countries) retains administrative inefficiency and remnants of a spoils system, why land reform is essential to prevent inflation in a developing country, why we have nothing to gain from pressing underdeveloped countries to liberalize trade, why credits and aid cannot be mixed, why cartels must be controlled, why European countries should remove import controls and export capital, why the Soviet countries do not integrate among themselves, why the U.S. may have to decrease its "cold war" aid in order to achieve true international aid on a large scale, why failure of the advanced countries to meet the present challenge might make Marx right in the end, how Western social science might become spiritually isolated from the needs of the world, why governments of underdeveloped countries must take the lead in their economies if capitalism is to have a chance there—and so many more!

I have learned much from this unique book and have been greatly stimulated. It should be required reading.

ROBERT B. SCHWENGER

Foreign Agricultural Service

Resource Productivity, Returns to Scale, and Farm Size, edited by Earl O. Heady, Glenn L. Johnson, and Lowell S. Hardin, Ames: Iowa State College Press, 1956. Pp. xi, 208. $3.50.

In 1954 a conference on farm-scale and resource productivity was

called by the North Central Farm Management Research Committee under the sponsorship of the Farm Foundation. The papers presented at this conference form the substance of this book. Its purpose, in the words of the editors, is . . . "to stimulate and aid productive thinking and research . . ." in resource productivity, returns to scale, and farm size.

The twenty-two papers and seven discussion statements are grouped under five headings. Part I, "Framework for the Problem," includes three chapters by Heady and Johnson setting forth some of the technical considerations in estimating production functions and general problems arising when studying resource productivity. Part II, entitled "Some Historical Accomplishments," is made up of three papers on the development of budgeting in the United States, the use of farm business records and surveys in doing research on the optimum size of farms, and a review of alternative methods used in studying farm size. Parts III and IV, entitled "Some Problems and Procedures" and "Illustrative Applications," make up a little more than half of the volume. A number of statements on alternative methods of determining resource productivity and several adaptations of the Cobb-Douglas type of function, which have been tried or suggested, are presented in this section. Short papers on sampling procedures applicable to research projects involving size of business and the use of significance tests in production function research also are included.

The final section, "Individual and Group Values in Farm Management Analysis," consists of three rather unrelated papers dealing with problems of small farms and their operators in using available resources, the use of theory in studying resource productivity that recognizes that "institutions are tools," and procedures for studying tenure problems that take into consideration social and personal factors as well as the more traditional economic ones.

The editors were assigned a difficult task. Even though more than three-fourths of the book was written by two members of the editorial committee and their former students or close colleagues, it was difficult to establish a great deal of continuity and avoid repetition in the offerings of 25 different authors. But since the book is directed primarily toward other research workers and graduate students with a basic understanding of production economics or experience with Cobb-Douglas type production functions, some of this lack of continuity can be overlooked. Even so, the reviewer wondered why Cecil Haver's rather elementary discussion of the interpretation of production function estimates was not included immediately following the early discussion of production functions by Heady and Johnson in Chapters 8 and 9, or left out completely. No less than 12 of the contributors discuss some of the more obvious limitations of estimating marginal productivities of various resources from Cobb-Douglas type production functions using cross-sectional farm data.

Yet, only two of these authors go very far in demonstrating how misleading these estimates may be. Earl Swanson's illustration of the kinds of results obtained when trying to determine the optimum size of business using cross-sectional production function data was the most helpful in this respect.

The book provides some useful additions to the growing amount of literature concerning resource productivity and production functions. Besides Swanson's excellent contribution, readers should find Chapters 7 and 8 by Heady on budgeting and linear programming in estimating resource productivity and cost relationships, and on the relationship of scale analysis to productivity analysis, a convenient review. Chapter 9 by Johnson on classification and accounting problems in using farm records to fit production functions is his best contribution in the book. Russell Olson's appraisal of methods used in studying farm size and the discussion which follows is challenging and helpful. Although generally on the cryptic side, the short chapter by Burton French which takes up the possibility of using a set of simultaneous equations to estimate production functions, may be of interest to a limited number. Likewise, some of the modifications of the Cobb-Douglas exponential type of equation suggested by various authors may be of interest to a few researchers.

On the other hand, a number of chapters, or at least parts of them, are either too obscure, repetitious, brief, or misleading to be very helpful. Some of the more obvious faults might have been overcome by careful editing. Occasionally errors have been overlooked. For example, the next to last sentence on the first page of Chapter 1 needs rewriting. An attempt to equate . . . "the partial derivative for each derivative with the product/price ratio" . . . could lead only to confusion rather than an optimum allocation of resources. Professor Tintner's discussion of tests of significance is no substitute for a course in statistics. The comments on sampling by West add little to the material presented by Wills in an earlier paper. The chapter by McAlexander comparing results from farm records and production function analysis is certainly misleading. His example taken from the Annual Report of the Southeastern Minnesota Farm Management Service for 1949 suggests that the averages presented are an . . . "attempt to arrive at the optimum level of livestock production or for crop yields." Anyone acquainted with these reports, which are returned to cooperating farmers, realizes that their primary purpose is to help these farmers evaluate their present position, not to determine what they should be doing to improve their position. Likewise, the comparison made in the paper between butterfat per cow and *profit per cow* is in fact one between butterfat per cow and *return over feed cost per cow*. The implications reported in the chapter are McAlexander's, not those of the staff at Minnesota.

This book is difficult to categorize. It is incomplete as a treatise on methodology and not a summary of research findings. However, parts of the book were stimulating to this reviewer. Research workers and graduate students will find the book a source of ideas and a useful reference work despite the fact that most of the subjects discussed have been treated at length in journal articles and other publications. Those who read the volume will be exposed mainly to the research ideas of Heady and Johnson, their students and colleagues, but few will have difficulty in finding within its pages sufficient material to reinforce some of their existing prejudices.

B. F. STANTON

Cornell University

The Terms of Trade: A European Case Study, Charles P. Kindleberger. New York: The Technology Press of Massachusetts Institute of Technology and John Wiley and Sons, Inc., 1956. Pp. xx, 382. $9.00.

The terms of trade have a place of honor in the history of international economics doctrine: One need only recall the literature on the gains from trade and on the price specie flow mechanism. As Kindleberger notes, attention has focussed more recently on the relation between the terms of trade and economic development, and on the mechanism of international income distribution. (These, too, are venerable themes: Ricardo and the Corn Laws.) The volume under review is an empirical study "to test existing theories concerning short- and long-run influences on the terms of trade against an amassed body of European statistical evidence" from 1872 to 1952 (p. v). The experience of Industrial Europe is clearly of great interest in a development context. The study also has the very considerable statistical advantage of benefitting from the greater availability of relevant European data over a longer period than for any other area.

To begin, Kindleberger develops two series of data: (1) indices of annual commodity export and import prices and trade terms (net barter terms) for the eight countries of what he calls Industrial Europe (the United Kingdom, Germany, France, Italy, Netherlands, Belgium, Sweden, Switzerland), which he extends to total current account; and (2) detailed indices of prices of exports and imports by commodity groups and by geographic areas for "key years." The author gives a careful statement of his methods and an appropriate warning as to the tenuous nature of the resulting data.

With these data, Kindleberger then tests a variety of hypotheses concerning the relationship between the terms of trade and other relevant economic variables. The findings are, for the most part, highly inconclusive, at least as to what can be established with the data amassed. The theoretical points turn out either to be statistically unverifiable or

not substantiated, hardly a surprising outcome to anyone who has himself attempted an investigation such as this. The results are not entirely negative, however. Kindleberger believes that the data support the widely-held notion that the terms of trade of underdeveloped areas have deteriorated with respect to developed areas (p. 233); and there is a fairly conclusive statement that there has been no marked trend of the terms of trade of manufacturers against primary products (p. 263), a finding that will be of particular interest, and likely to be disputed. In Kindleberger's view, the key to the behavior of the terms of trade between developed and underdeveloped areas is to be found in the relative mobility of resources. Underdeveloped areas appear chronically handicapped in this respect. The author suggests that the behavior of the trade terms must be sought not in a general investigation of the prices of primary products versus manufacturers, which he believes is a largely irrelevant notion (p. 270), but in an examination of the *particular* types of goods entering into trade between *particular* countries. In fact, Kindleberger concludes that concentration on the terms of trade is a wrong emphasis from a policy viewpoint. The significance of this will not be lost to agricultural economists.

The relationship between what a country gets for its exports and what a country pays for its imports is important from a national viewpoint. But this only begs the question: What precisely is the significance of the terms of trade and its changes? Kindleberger has a number of shrewd (although by no means original) observations on this score. Among other things, he stresses the limitations of partial equilibrium analysis of elasticities of supply and demand for dealing with what are essentially problems in general equilibrium analysis, a point that this reviewer finds particularly important not only for the theory of the terms of trade, but also for exchange rate theory, for tax theory (including the theory of trade barriers), and for the theory of income distribution.

Two broad criticisms of this study seem appropriate. First, there is no integrated discussion of the various terms of trade concepts and their relevance, although scattered statements may be found. The author stated that he would "attempt little conceptual innovation" (p. 7), but it would have served to set the stage somewhat better if he had devoted some space to concepts. In fact, the bulk of the discussion is of the net barter terms of trade. (Parenthetically, the use of the ratio of the price of exports to the price of imports for the trade terms instead of the more common reverse ratio is highly commendable.)

Second—and more important—the author specifically eschews a treatment of the effects of changes in the terms of trade on development (p. 257), a problem that is of considerable current interest, as Kindleberger himself recognizes, and that is really the rationale of this study.

This omission is curious, since the author does discuss the effects of the terms of trade on the balance of payments and national income and on the allocation of investment funds between foreign and domestic investment.

A reading of this book tempts one to jump to a broad conclusion: That, as in domestic trade, prices in international trade may not be as important as much of the literature suggests. The existence of uncertainty, oligopoly market structures, government intervention, and product differentiation compel attention to other aspects of market behavior besides prices to explain the course of international trade and its consequences.

This book is not for the general reader. It will probably be widely used as a reference source, mainly because of the detailed statistics. This reviewer cannot restrain an expression of horror at the price of the volume. The Merrill Foundation, which financed the study, apparently did not subsidize publication.

BERNARD GOODMAN

Wayne State University

Wirtschaftslehre des Landbaus,[1] *Handbuch der Landwirtschaft,* Bd. V, 774 p. Edited by Roemer-Scheibe-Schmidt-Woermann Paul Parey, Hamburg 1954.

The Agricultural Manual intends to present a survey about the questions and problems of the total agricultural production. The first four volumes discuss the technological problems in their broadest sense (cultivation of soil and plants, animal breeding and animal nutrition etc.). The fifth volume is dedicated to the problems of agricultural economics. Volume V, of fourteen chapters, especially treats three subjects:

1. The principles of agricultural policy.
2. The problems of general and specific farm management.
3. Questions such as tenancy, farm credit, and extension service, which touch both the spheres of agricultural policy and farm management.

Considering the abundance of material, the first part is complete and reads remarkably well. In this part Professor *Abel* presents a survey about the institutional and sociological factors operating in the agrarian sector (land structure and legislation, labor structure, and farm credit) on the one hand and economic forces such as price and market policy on the other.

In this, Professor Abel proves himself to be an authority, especially in regard to historical interrelationships. Nevertheless, he is not bound to the past in his reflections, but leads the historical interrelationships into the present and supplies a concrete picture of the economic and legal environment in which agriculture is producing today.

[1] "Farm Economics," *Manual of Agriculture,* Volume V, pp. 774.

In the second part, which deals with special problems of farm management, nearly all the present leading agricultural economists of Western Germany contribute some part. In the first chapter, "The Farm Business as an Organism and its Components," Professor *Busch* presents a well arranged survey about the parts of the agricultural business (land and the different forms of capital) and their properties essential for the management of farms.

In the following part, Professor *Lang* renders a general view about the present status of the theory of location. Closely following the well known work of Brinkmann, *Die Ökonomik des landwirtschaftlichen Betriebes*[2] he distinguishes between differentiating factors (location, technological status, economic development and natural conditions) and integrating factors (the compulsion for the balance of labor and fodder and for the maintenance of soil fertility), and investigates their influences on the intensity and direction of production.

Although Lang (in his investigations) doesn't go beyond the qualitative treatment of the problems affected by the organic character of agricultural production, *Woermann* goes a step further in the chapter, "The Balance of Price and Cost in Farming," and shows possibilities for the quantitative establishment of the cumulative relations among the separate parts of the business. With this, he advances into spheres to the theory of farm management unexplored until now and endeavors to make the knowledge of the German theory of location (Brinkmann, Aereboe) useful for the calculation of the most appropriate farm organization.

Since *Thünen*, the German theory of location shows a noticeable gap–the investigation of the influence of the farm size as an independent factor of location. *Priebe* inquires into this influence in Chapter V, "Farm Size and Farm Organization." Although his investigations do not always meet strict requirements of the statistical methods, the author did succeed in obtaining quite informative results. They can seldom be found in such completeness and clearly show the trends in the different size groups to strive for definite types of farm enterprises.

Chapter VI-X turn to special problems of farm management. While *Ries* devotes himself to the problems of labor efficiency which have been coming into the foreground more and more recently, *Rolfes* and *Woermann* investigate the types of farm organization as they develop under the influence of different factors of location. Here, especially in the part of Woermann, the endeavors become evident not only to describe the occurring types of enterprises, but also to develop practical methods of

[2] An English edition was published in the United States: *Theodor Brinkmann's Economics of the Farm Business*. With introduction and notes by Elisabeth J. Benedict, Heinrich H. Stippler, and Munas R. Benedict, Berkeley, California, 1935.

calculation upon which the individual types of animal production enterprises can be marked off from each other.

Chapter IX, "Farm Planning," in which Professor *Blohm* endeavors to show the principles of planning in farming, is in a way a summary of all the farm management problems discussed in the preceding chapters. Blohm's strictly summarized and well arranged statements essentially remain in the qualitative discussion of the problems. Blohm advocates the conception that in the main a calculation of profitableness can only be carried through by means of the model farm or by comparison of farms because of the close connections of the separate enterprises. A discussion of the possibilities of making the relationships among the enterprises quantitatively conceivable, and of the conclusion for farm planning hence derived, would have been desirable.

In the closing parts of the second chapter, "The Financial Supervision of the Farm Business," and in the preceding Chapter VIII, "Measures of Productivity and Profits," the means given to the farmer for the supervision of the farm are described and discussed. Following the terms coined in political economy, *Geuting* describes the criteria by which the profit can best be learned. *Rintelen* investigates and describes "The Agricultural Bookkeeping" in its function of supervising the farm business financially.

In Chapters XI-XIV, individual problems which were already touched in Professor Abel's introductory chapter are scrutinized once more. Their importance to agrarian politics and farm management, however, is so great that a detailed discussion seems to be justified here. Problems of extension service, tenancy, the financing of farms and the standard valuation (Einheitsbewertung) in taxation are mentioned again. All four chapters are well arranged and show a very detailed treatment of subjects.

For some of the foreign readers, the last chapter about the methods of standard valuation may be of special interest. The standard valuation which is treated thoroughly and carefully here by the official adviser of the federal ministry of finance, *Herzog*, forms the basis of the taxation of farms in Germany.

On the whole, one who is interested in German thoughts and contributions to agricultural economics will find considerable in this handbook.

GÜNTHER WEINSCHENCK

University of Göttingen, Western Germany
Institut für landw. Betriebslehre, Göttingen, Nikolausberger Weg 11

Forest and Range Policy: Its Development in the United States, Samuel T. Dana. New York: McGraw-Hill Book Company, 1956, Pp. 455. $6.50.

This book is a worthy addition to the growing list of textbooks in the American Forestry Series published by McGraw-Hill Book Company. It is the most comprehensive book now available summarizing the origins and development of forest and range policies in the United States. As such, it will unquestionably become a standard reference for those dealing with historical and policy aspects of the conservation of natural resources.

The author, Samuel T. Dana, Dean Emeritus of the School of Natural Resources, University of Michigan, is one of the elder statesmen in the forestry profession. Having spent more than 20 years in the U. S. Forest Service in administrative and research assignments, and nearly as much time teaching conservation at the University of Michigan, he is eminently qualified to write about the elusive subject of policy. Not only did he know and work with many of the pioneers in conservation, but he participated in policy decisions.

Twelve chapters constitute the body of the book. In addition, there are three useful appendixes: a survey of federal policy on wildlife, soil, water, and minerals; a chronological summary of events relating to conservation of natural resources; and a selected bibliography. The chapter arrangement is chronological. Starting with a chapter on Colonists, Kings, and Forests and continuing with chapters on Acquisition and Disposal of Public Domain, Exploitation of Timber and Forage, Forestry in the Offing, Forest Reserves Arrive, and Prelude to Progress, one gets a handy compendium of early history.

The next five chapters deal rapidly with the principal events of the 20th century—establishment of federal forestry in the Department of Agriculture, passage of the Weeks law setting a pattern of federal-state cooperation in fire protection and land acquistion for watershed protection, enactment of the McSweeney-McNary law establishing regional forest experiment stations, development of grazing policies, attempts to set forth the national timber situation, and broadening of forest and range conservation under the New Deal. The events of the last 15 years are presented in a chapter entitled "Forestry Comes of Age." All in all, these chapters are an impressive summary of events and show how rapidly forest and range policies have been developing. "Summary and Analysis" is the title of the last chapter, although each preceding chapter also has a summary. In the 28 pages of this last chapter, the main policy developments are drawn into perspective—and the author does a masterful job within the space used.

Looking critically at the book, however, this reviewer feels its value would have been enhanced by greater emphasis on the relation of forest policy to other events of the time. Industrial and agricultural trends, political events, and population movements all influenced the origin and

development of forest and range policy. Had these relationships been given greater stress, the text would have been lengthened materially, but the reader would have had a better realization of the place and significance of events influencing policy as it evolved.

Agriculturists, foresters, economists, and others dealing in conservation policy problems will find Dana's book an encyclopedia of facts, presented with an objectivity that is rare in discussions of policy. Because of the author's broad perspective and close association with policy problems, he writes with an authority and clarity that readers will appreciate. All in all, the book is the best text by far for putting into perspective the development of forest and range policy in the United States.

M. B. DICKERMAN
Director, Lake States Forest Experiment Station, St. Paul, Minnesota

Policies to Combat Depression. National Bureau of Economic Research. New Jersey: Princeton University Press, 1956. Pp. x, 417. $8.50.

This book presents papers from two conferences at Princeton in the fall of 1953 and the spring of 1954. The participants, both those who contributed papers and those whose comments on them are published, include leading names in such fields as business cycles, monetary theory and policy, and public finance.

Two of the fourteen papers are directly concerned with agriculture. By space, these comprise about one-fifth of the book. Beyond the comment that the other papers in this book are a useful compendium of studies relating to contracyclical policies, this review will discuss only the papers on agriculture. The first paper on agriculture is by Karl Fox, entitled "The Contribution of Farm Price Support Programs to General Economic Stability," with comment by James Bonnen and reply by Fox. The second paper on agriculture, by Gale Johnson, is "Stabilization of International Commodity Prices" with comment by Wilfred Malenbaum.

Based on rather elaborate statistical estimation of economic relations and on thorough review of provisions of legislation pertaining to agriculture, Fox's results imply that price support programs make at most a small contribution in combatting depression. Over a three-year period of hypothetical severe recession which Fox contemplates, gross national product would have fallen 21.4 per cent without an agricultural support program and 19.7 per cent with a support program (comparing January of first recession year with January of third recession year in table 11, page 338). The increased income attributable to the price support program is shared about equally between farm and nonfarm people (page 339); of course, the increase would be much more important to farm people as it would be spread over a fewer number of persons.

Alternative programs that Fox contemplates (e.g. multiple price plans,

compensatory payments), seem to have practically identical implications as to effectiveness in combatting depression. The acreage and conservation reserve provisions inaugurated this year are of a type not included in Fox's analysis, as these were not under serious discussion at the time of his analysis. A payment in connection with these provisions—being more akin to a transfer than an expenditure on goods and services—would not have as large a multiplier as a price support payment of equal magnitude. On the other hand, if both types of payment were continued in a depression, the new provisions might have the effect of adding to the total contracyclical effect of agricultural programs. But these considerations do not seem likely to alter the general nature of Fox's finding as to the smallness of the effect.

The usefulness of Fox's analysis for those who wish to undertake further research in this area is impaired by the fact that Fox presents the results of his analysis without explicit directions as to how the results might be reproduced. We have only these clues (from page 329):

> In making the farm price, production, and income projections . . . I have tried to estimate for each major commodity or commodity group the prices and rates of production which would result from the assumed decline in consumer income and from the interaction of livestock and feed prices. Time lags in the adjustment of livestock and crop production were taken into account commodity by commodity. In estimating these price and production changes, statistical demand and supply relationships were extensively used, but with coefficients rounded to one or at most two significant figures. The projections as a whole are partly plastic or intuitive—they are not precisely defined by a set of structural equations, although the equations implied in the results could be written out.

As Bonnen emphasizes, Fox's paper is pioneering as the first quantitive study of its subject. The paper represents an important step; at the same time, it is to be hoped that the paper will stimulate further study. As a next step it would be particularly interesting to try to cast Fox's type of analysis into a formally complete aggregate model of the economy, perhaps along the lines that he refers to in the quotation just given. A significant issue is implicitly raised in the comments following the paper that suggests additional investigation. Is the contribution of price support programs small—but definitely larger than zero—as would be suggested by Fox's paper; or is it zero, as suggested by his reply to Bonnen?

The other paper on agriculture in this book might be characterized as a lecture on the fundamentals of international commodity price stabilization. In brief outline, Johnson does not believe that import and export quotas are good instruments of stabilization, both because they often break down as a practical matter and because they do not achieve the contracyclical goal of stability in the value of trade. Regarding commodity reserve schemes (i.e. stabilization of an index of prices of a group of

commodities), he points out that differing income elasticities will result in large variations in the prices of individual commodities. He offers the unique solution to this problem of weighting the commodities in the index according to their income elasticity of demand. On net, however, he is not enthusiastic about commodity reserve schemes. Regarding stabilization of prices for individual commodities, the conclusion is that it would be feasible to achieve cyclical stability for commodities with a small income elasticity of demand, although the costliness of such programs is emphasized. He points out that the over-all contribution of such programs to cyclical stability would necessarily be small. He closes by recommending consideration of individual programs of stabilization of demand of various United States imports, both as a means of preventing United States depressions from interrupting progress of underdeveloped countries and as a means of stabilizing the demand for United States exports. But he does not feel that these programs would be centrally important in achieving economic stability either.

Malenbaum's discussion elaborates on Johnson's closing remarks and suggests that stabilization schemes might be used as an instrument of income transfer to less developed countries.

A principle value of Johnson's paper is its lucid and faithful attention to the economic fundamentals of international commodity price stabilization. In addition, the paper is provocative because it is sprinkled with numerical examples, representing Johnson's beliefs as to approximate magnitudes of price and income elasticities for various primary goods that are traded internationally. The effect is to call attention to the importance of the elasticities and to the need for studies aimed at definitive numerical estimates. Another contribution of Johnson's paper is that, if his conclusion is accepted that participation in international stabilization schemes for the United States ought to consist of individual buffer programs for its major imports, some redirection of research and discussion in the area of international commodity price stabilization is suggested.

One hopes that agricultural economists will not lose sight of these two papers due to the fact that they are included in a volume that does not deal primarily with agriculture. This would be unfortunate, not only because they come to significant conclusions in their own right, but also because they should be helpful in shaping future studies in their respective areas.

GEORGE S. TOLLEY

North Carolina State College

Die Nachfrage nach Nahrungsmitteln und ihre Abhaengigkeit von Preis- und Einkommensaenderungen, Heinz Gollnick. Hamburg-Berlin: Verlag Paul Parey, 1954. Pp. 110. DM 2.00.

After World War II German agricultural economists initiated a series of publications on agricultural marketing research. The first five issues dealt with such problems as the world market for wheat, subsidization of British agriculture and problems associated with the marketing of milk and vegetables. Publication No. 6 deals with the demand for food and its dependence upon price and income changes. It is a statistical analysis of the demand for five food items—eggs, cheese, butter, oleomargarine and meat—consumed by groups of wage earners and salaried workers in the city of Hamburg, Germany, during the period August 1, 1949-July 31, 1950. The author used budget accounts that had been kept by a total of 104 households of wage earners and salaried workers during those 12 months. For the sake of comparability, he converted family members into adult equivalents. For instance, a child below 9 years of age was counted as half an adult. Wage earners were divided according to income into two groups, with an annual income of 1,400 DM per adult as separating criterion. Salaried workers were divided into three groups, with annual incomes per adult below 1,400 DM, between 1,400 DM, and 1,800 DM, and above.

The hypothesis that was tested in connection with monthly egg consumption, was as follows:

$$\log x_e = b \log p_e + c \log y + d \log p_k + g \log p_b + f \log p_m + e \log p_f,$$

where x = quantity,
p = price,
y = income,
subscript e = eggs,
subscript k = cheese,
subscript b = butter,
subscript m = oleomargarine, and
subscript f = meat

Using average monthly data for the 12 months August 1949-July 1950 pertaining to salaried workers' households with annual incomes per adult of more than 1,800 DM he obtained an R^2 of 0.975. About equally good fits were obtained for the other income groups as well as for cheese, butter, oleomargarine and meat consumption.

Price elasticities of eggs varied between -2.0 and -3.5, with the price elasticity inversely related to income. The price elasticity of cheese, depending on employment and wage group was -0.3 to -0.7, that of meat -0.3 to -1.1, that of butter -2.0 to -3.9, and that of oleomargarine -0.4 to -1.7. In most cases the price elasticity is highest for the lower income groups.

Also cross elasticities were calculated. The results were not very consistent, particularly since some of the price elasticities were statistically not significant. However, eggs and cheese, were found to compete with

one another, and so were butter and cheese. Butter and eggs were found to supplement one another.

Income elasticities were also computed. However, since income per adult was stable over the period, except for a temporary increase around Christmas, not much useful information on this subject was produced.

This statistical study is a milestone in agricultural marketing research in Germany. It acquaints those who do not read English with certain statistical market research methods which were developed and extensively used during the last quarter century in Anglo-Saxon countries. The author exhibits a high degree of craftsmanship in using these tools.

In the United Kingdom and in the United States statistical demand analyses have been made for numerous commodities, most of them for the producer-manufacturer level. Usually macro-economic data have been used. Gollnick's study, although using conventional least squares techniques, relies on budget account data and is interesting from this point of view. Unfortunately, the author tells us very little about the nature of the accounts, the selection of the households and their representativeness. Nevertheless, this study points the way to some interesting methods of inquiry into consumer's demands for certain commodities, perhaps in conjunction with an inquiry into consumer's spending and savings habits. These two aspects could complement one another. In such a case, a carefully designed probability sample and budget accounts should be relied upon. Such a method, would make possible a cross section analysis in addition to a time series analysis. This reviewer would have liked to find a cross section analysis of the budget data included in this study, which may have provided useful information on income elasticities.

Comparing the empirical price elasticities of this study with those found in the United Kingdom and the United States for the period 1920-40, some general similarity is evident, but the values produced by this study appear to be somewhat higher.

For the economist trained in statistical methods this study offers profitable and informative reading. However, it suffers from one important limitation. After the data have been processed and certain parameters estimated, we find ourselves at the end. The meaning and particularly the implications of the empirical findings are not discussed anywhere. If this book had made methodological contributions to the field of market research, it could stop here and rest on its laurels. Since that is not the case its merit is greatly reduced by its failure to answer the inevitable question "What does it mean?"

WERNER Z. HIRSCH

Washington University

NEWS NOTES

ROBERT J. ANTONIDES, Assistant Professor of Economics at South Dakota State College, returned to his duties September 1, after a year's leave spent in study toward the Ph.D. degree at the University of Minnesota.

JOHN M. BAILEY, who graduated with an M.S. degree in Agricultural Economics from Utah State Agricultural College in 1954 and with a Ph.D. degree in Agricultural Economics from Cornell University in 1956, has been employed by the Farm Supplies Branch of Farmer Cooperative Service, U. S. Department of Agriculture. He will work on credit, inventory, and merchandising problems of cooperatives handling farm production supplies.

GEORGE W. BARR, who has been on leave as Head of the Arizona Watershed Project, has returned to his duties as Head of the Department of Agricultural Economics at the University of Arizona.

CHARLES BEER has been appointed Instructor in Farm Management Extension at Michigan State. Formerly a county agent in Minnesota, he has completed the course work for the doctorate at Michigan State.

MALCOLM I. BEVINS joined the staff on July 1 at the University of Vermont as Assistant Agricultural Economist. He came to the University of Vermont after a two-year tour of duty with the Air Force and graduate work at Purdue University. He will be engaged in farm management research.

O. P. BLAICH has accepted a position of instructor with New Mexico A & M College. Blaich did his undergraduate work at the University of Manitoba and received his M.S. degree from the University of Minnesota. He resigned a position as Agricultural Economist with the Department of Agriculture of British Guiana, at Georgetown, B.G.

JAMES O. BRAY is leaving Kansas State College to accept an appointment with the University of Chicago for an assignment at the University of Santiago in Santiago, Chile.

B. L. BROOKS, Extension Marketing Specialist at Montana State College, resigned to accept a similar position at State College of Washington effective August 1.

C. B. BROTHERTON, Assistant Professor of Agricultural Economics and Economics at Montana State College, has resigned to join the Office of Western Livestock Marketing Researih at Denver.

DEAN A. BROWN has been appointed District Extension Economist for Central Iowa at Iowa State College. He will be responsible for economic aspects of the extension program in a group of Central Iowa Counties and will carry the rank of Associate in the Department of Economics and Sociology.

HARVEY W. CALDWELL has rejoined the Department of Agricultural Economics, Ontario Agricultural College, Guelph, Canada, after two years' leave of absence at Oregon State College, where he has obtained his Ph.D. degree. He now becomes an Associate Professor.

GEORGE W. CAMPBELL, JR. has been appointed Extension Agricultural Economist with the Arizona Agricultural Extension Service.

E. D. CHASTAIN, formerly of the Agricultural Economics staff at Virginia Polytechnical Institute who recently completed the requirements for the Ph.D. degree at Purdue University, has joined the Agricultural Economics staff at Alabama at Auburn.

NORMAN L. COLLINS has resigned from Kansas State College to accept a position in the Department of Agricultural Economics at the University of California.

JOHN CRECINK has transferred from the Western Section of the Production Economics Research Branch, ARS, to the Agricultural Finance Section in Washington. Mr. Crecink received his Ph.D. from Iowa State College in June.

GEORGE V. DOUGLAS joined the Agricultural Economics Branch, TVA, as social science analyst last spring. Prior to coming to TVA, Douglas was conducting research in rural community development at Pennsylvania State University.

WILLIS EICHBERGER, Production Economics Research Branch, ARS, has transferred from Ames, Iowa to Little Rock, Arkansas.

RICHARD G. FORD joined the staff of the Division of Agricultural Economics Programs, Federal Extension Service on July 16. Mr. Ford is responsible for extension leadership in agricultural outlook and marketing information programs in the General Economics and Rural Sociology Branch. He comes to the Washington staff after a year and a half with the New Jersey Extension Service. Previously he had served with the Nebraska Extension Service, and his economics training was gained at Kentucky and the University of Chicago.

WALTER U. FUHRIMAN of the Bureau of Indian Affairs will assist, on a reimbursable basis, with the Production Economics Research Branch, ARS, program of research on the problems of low-income farmers. Mr. Fuhriman is a former member of the old BAE Division of Farm Management and Costs.

GLEN D. FULCHER has reported for duty with the Production Economics Research Branch, ARS, at Madison, Wisconsin. Mr. Fulcher served two years with the Bureau of Land Management in Idaho. More recently, he was at the University of Wisconsin taking graduate work toward his Ph.D.

ARTHUR G. GEORGE, Associate Agricultural Economist at Nebraska, retired July 1. He is living in Lincoln, Nebraska.

LOYD GLOVER, of the South Dakota agricultural economics staff, has been appointed to the Production Economics Research Branch, ARS, as cooperative agent with the South Dakota Agricultural Experiment Station.

FRANK HANSING of the Production Economics Research Branch, ARS, has transferred from Delaware to the Agricultural Finance Section in Washington, D.C.

ROBERT W. HARRISON has joined the Southern Field Staff of the Production Economics Research Branch, ARS, at Little Rock, Arkansas. Mr. Harrison

was formerly with the old Division of Land Economics, BAE, and subsequently with the Bureau of Land Management and the Jameson Family Trust.

EARL O. HEADY has been appointed to the Charles F. Curtiss Distinguished Professorship in Agriculture at Iowa State College. He is the first person to receive this honor. He spent the Spring semester as Visiting Professor of Economics at Harvard University.

G. W. HEDLUND, Head of the Department of Agricultural Economics at Cornell, left June 14 for Los Banos, Philippine Islands. He will take over the responsibilities for the Agricultural Economics program in the Cornell project with the College of Agriculture, University of the Philippines.

PHILIP A. HENDERSON has been appointed half-time Agricultural Extension Service and half-time Agricultural Experiment Station at Nebraska effective July 1.

CARROLL HESS has joined the Northern Field Staff of the Production Economics Research Branch, ARS, and is stationed at Ithaca, New York. For the past 5 years Mr. Hess has been on the faculty of Southern Illinois University at Carbondale.

ROY E. HUFFMAN, Head of Agricultural Economics and Rural Sociology at Montana State College, was elected Chairman of the Western Agricultural Economics Research Council for 1956-57. He succeeds Dr. G. B. Wood of Oregon State College who has served as Chairman of the Council for the past two years.

T. N. HURD, Professor of Business Management, Cornell, is serving as Acting Head of the Department of Agricultural Economics during the absence of G. W. Hedlund.

J. E. JEFFRIES was appointed as Instructor in Agricultural Economics at Ohio State University, July 1, 1956. He will work in the field of fruit and vegetable marketing research.

CANUTE JOHNSON, Assistant Professor of Economics at South Dakota State College, is presently on leave engaged in study toward the Ph.D. degree at the University of Minnesota.

HUGH A. JOHNSON has joined the Land and Water Section of the Production Economics Research Branch, ARS, in Washington, D.C. For the last year he has been at the Littauer School of Public Administration at Harvard. From 1949 to 1955 he headed the agricultural economics staff at the Alaska Agricultural Experiment Station, Palmer.

DONALD F. JONES has joined the staff of Colorado A & M College as an instructor and junior economist. He recently received his Master's degree from Montana State College.

C. DELMAR KEARL rejoined the staff of the Department of Agricultural Economics at Cornell University on July 1, 1956. He has served the past two years at the College of Agriculture, University of the Philippines, Los Banos, helping in the development of the work of the Department of Agricultural Economics there.

GERALD E. KORZAN, Associate Professor of Agricultural Economics, returned to his position at Oregon State College on September 15. For the past two years Dr. Korzan has been a member of a mission from Oregon State College to Kasetsart University of Thailand where he has been working with the Division of Cooperative Sciences in developing a teaching and research program.

ROBERT KRAMER is taking sabbatical leave from Michigan State University for 1956-57. He is on a Business Fellowship at General Mills during August. He will do post-doctorate training at Harvard during the academic year, assisting in the Moffat Program in Business Administration in the spring term. He will visit in the U. S. Department of Agriculture during the summer of 1957.

KRIS KRISTJANSON resigned August 1 to accept a position with the Department of Northern Affairs and National Resources of the Canadian Government, stationed at Ottawa, Ontario, Canada.

ERVEN J. LONG, Head of Department and Chairman of the Section, is on a two-year leave of absence, serving as Group Leader for the University of Tennessee, College of Agriculture Program in Southern India. Dr. D. M. Thorpe, Extension Economist, will serve as Acting Head of the Department during Dr. Long's absence.

PATRICK J. LUBY has accepted an appointment at Purdue University as Assistant Professor in Agricultural Economics in Marketing Research. Dr. Luby is a native of Ohio and has done graduate work at Ohio State University and completed his Ph.D. requirements at Purdue.

MURRAY A. MACGREGOR has rejoined the Department of Agricultural Economics, Ontario Agricultural College, Guelph, Canada, after two years' leave of absence at Cornell University, where he has obtained his Ph.D. degree. He becomes an Associate Professor.

ARTHUR B. MACKIE joined the TVA, Agricultural Economics Branch, on July 1, 1956. Previous to coming to TVA, Mackie was a member of the Department of Economics staff at Iowa State College.

WILBUR R. MAKI has joined the staff of the Department of Economics and Sociology, Iowa State College, as an Assistant Professor. He will be primarily concerned with livestock marketing research.

TRAVIS W. MANNING, formerly Associate Professor of Agricultural Economics at South Dakota State College, has joined the staff of the University of Arkansas.

ROBERT G. MARSHALL has joined the staff of the Department of Agricultural Economics, Ontario Agricultural College, Guelph, Canada, to undertake research and teaching in the field of marketing.

RAYMOND D. MCKINNEY has been appointed assistant professor in the Department of Agricultural Economics at Kansas State College. His responsibilities will be in research relating to conservation and watershed development.

RUSSELL MIDDLETON has been appointed assistant professor in the Department of Economics and Sociology at Kansas State College to teach sociology and rural sociology during the absence of Professor Randall C. Hill who is on an assignment in India. Professor Middleton is a graduate of the University of Texas and during the past year has done postdoctoral study on a Fulbright fellowship at Oxford University.

CLARENCE J. MILLER was promoted to Associate Professor of Agricultural Economics at Nebraska on July 1. He has been granted a six months' leave of absence, effective July 1, 1956 to January 1, 1957, to accept an FAO assignment as agricultural economist and adviser to the Government of Venezuela, South America.

RUSSELL MAWBY has transferred from the Agricultural Economics Department to become the Assistant Director of Extension in charge of 4-H Club work at Michigan State University.

MARVIN P. MIRACLE, graduate student in the Food Research Institute of Stanford University, has been awarded a 2-year foreign area training fellowship by the Ford Foundation in connection with its African program.

JAMES MITCHELL finished his Master's Degree in Agricultural Economics at the University of Rhode Island and is currently working as an Economist for the Southern New England Soil Conservation Service.

JOHN A. NORDIN has been appointed Professor in Charge of Instruction in the Department of Economics and Sociology at Iowa State College. He will have primary responsibility for policy and operations connected with the Department's teaching program and will be closely associated with the Department Head, Karl A. Fox, in other aspects of department administration.

W. ROBERT PARKS, formerly Professor of Government at Iowa State College, has joined the University of Wisconsin where he holds an appointment as Professor in Agricultural Economics and the National Agricultural Extension Center for Advanced Study.

ANTHONY L. PAVLICK joined the South Dakota State College staff as assistant professor on July 1. He was formerly engaged in research at the University of Minnesota, where he is completing the requirements for the Ph.D. degree.

J. F. PITTMAN and W. H. THOMAS, assistant agricultural economists for the South Carolina Experiment Station, have been granted leave to attend Pennsylvania State University to do further graduate work.

WILLIAM F. RAILING, Assistant Professor of Economics, returned to South Dakota State College September 1, after teaching summer school at Omaha University.

OAKLEY M. RAY recently resigned his position as marketing specialist on the staff of the Department of Agricultural Economics at Purdue University to accept a position with the American Meat Institute at Chicago.

MARK REGAN, Production Economics Research Branch, ARS, is on a year's

leave from his Washington assignment. He will work with the Ceylon government on its agricultural resource development program.

REX D. REHNBERG, Acting Head of the Department of Economics and Sociology at Colorado A & M College for the past two years, was made Head of Department on July 1.

JOHN C. REDMAN, Associate Professor, University of Kentucky, has geen granted a sabbatical leave to accept a post-doctoral award from the Social Science Research Council for a full year's study and research in economics. Dr. Redman will be at the University of Chicago starting this fall.

KEITH ROBERTS, who has been on leave for graduate study at the University of Kentucky, returned to his position as Assistant Professor of Agricultural Economics, University of Florida, on August 15, 1956.

R. STEPHEN RODD has resigned from the Ontario Agricultural College, Guelph, Canada, in order to pursue doctoral studies at Massachusetts Institute of Technology.

VERNON ROSS joined the Extension Staff at the University of Tennessee on August 1, 1956 as an Assistant Agricultural Economist.

EWELL P. ROY joined the teaching and research staff of the Department of Agricultural Economics, Louisiana State University on July 1, 1956. He was formerly coordinator for the regional poultry research project on which several southern experiment stations are cooperating. Dr. Roy will teach a course in cooperative marketing and do research in marketing.

ELMER SAUER has transferred from the Production Economics Research Branch, ARS, to become ARS-SCS Research Liaison Representative in the Corn Belt, with headquarters at Urbana, Ill.

JOHN A. SCHNITTKER returned to Kansas State College on July 1, 1956 to accept an appointment as assistant professor in agricultural economics. He will assume the teaching and research responsibilities formerly held by James O. Bray.

J. T. SCOTT has joined the staff of the Department of Economics and Sociology, Iowa State College, as an instructor. He will teach and conduct research in agricultural marketing and will assist Raymond R. Beneke in directing the Agricultural Business Curriculum.

ROBERT O. SINCLAIR has accepted a position as Assistant Professor of Agricultural Economics at the University of Vermont. He is completing the residence requirement for the Ph.D. at Michigan State University. At the University of Vermont he will direct teaching and research in the field of agricultural finance.

MILTON M. SNODGRASS has accepted an appointment as Assistant Professor of Agricultural Economics in Research and Teaching at Purdue University. Dr. Snodgrass is a native of Pennsylvania and recently completed the requirements for the Ph.D. degree in Agricultural Economics at Purdue University.

HOWARD STEELE, who recently received his M.S. degree from Pennsylvania

State University, became Assistant Agricultural Economist at Clemson on September 1. He will work in the field of dairy economics.

EDWIN STRAND, who has been on leave from the Production Economics Research Branch, ARS, for graduate study at Iowa State College, has returned to his headquarters at Washington, D.C.

FORREST STRAND has accepted an appointment as Coordinator of the Consumer Marketing Information Project in Detroit. A former vocational agricultural teacher, Strand has completed the course work for the doctorate at Michigan State University.

BORIS C. SWERLING is on a year's leave of absence from the Food Research Institute of Stanford University to serve on the staff of the President's Council of Economic Advisers.

MARLOWE TAYLOR, Economist with the Production Economics Branch, A.R.S., is being transferred from Washington, D.C., to New Mexico A & M College, State College, New Mexico. He will work under a cooperative arrangement with the College on the low-income farm problem.

JOHN E. THOMPSON, Assistant Professor of Economics at South Dakota State College, is spending a year's leave at the University of Wisconsin, where he is working toward the Ph.D. degree.

ERIC THOR, Associate Professor of Agricultural Economics, University of Florida, has accepted a position with Corning Glass Company, Corning, New York, effective November 1, 1956. He will do research in facilities planning.

JACK L. TURNER was awarded his Master of Science degree in Agricultural Economics by Alabama Polytechnic Institute in June and accepted a position as assistant in agricultural economics in studying consumer acceptance of selected newly-developed horticultural products.

WINSTON K. ULLMAN, Assistant Professor of Economics, returned to South Dakota State College August 1, after a year's leave spent in study toward the Ph.D. degree at Cornell University.

LAWRENCE W. VAN MEIR has resigned from Kansas State College to accept an appointment with the Food and Agriculture Organization. He will be stationed at Mexico City and will make a survey of livestock marketing in the Central American countries.

PHILIP W. VAN VLACK returned to the staff of South Dakota State College as Associate Professor on August 1. He had recently been engaged in counseling and graduate study at Columbia University.

FRED C. WEBSTER joined the staff at the University of Vermont on July 1 as Assistant Professor of Agricultural Economics. Dr. Webster received his Ph.D. at Cornell University for work in the field of agricultural marketing. At the University of Vermont he will direct research in the field of dairy and livestock marketing.

G. P. WIBBERLEY, Head of the Agricultural Economics Department at Wye College, has been granted a university appointment at the London School

of Economics and Political Science, University of London, as Reader in Agriculture with special reference to Agricultural Economics. Dr. Wibberley will continue as Head of the Department at Wye.

J. HUGH WINN has been appointed Assistant Professor of Agricultural Economics and Economics at Montana State College. His responsibilities will include both teaching and research; the latter being in the field of livestock marketing.

N. A. WYNN, formerly of the University of Georgia, has joined the staff of the South Carolina Experiment Station as an Assistant Agricultural Economist to do production economics research.

AFEA WINTER MEETING IN CLEVELAND, OHIO

December 27-29, 1956

Thursday, Dec. 27, 9:00 a.m., Statler Hotel

Training Foreign Students in Agricultural Economics
American Farm Economic Association

Chairman: Mervin G. Smith, Ohio State University
International Centers in Agricultural Economics and Statistics—Food and Agriculture Organization Experience Over a Decade, Mordecai Ezekiel, Food and Agriculture Organization of the United Nations
A Decade of Training Foreign Students in the United States, Kenneth Parsons, University of Wisconsin
Discussion: E. C. Young (Ezekiel), Purdue University; H.C.M. Case (Parsons), University of Illinois

Thursday, Dec. 27, 2:00 p.m., Statler Hotel

Economic Implications of Agricultural Experiments
Econometric Society and American Farm Economic Association

Chairman: Clifford G. Hildreth, Michigan State University
Planning Cooperative Research With Agricultural Technologists, Earl O. Heady, Iowa State College
Statistical Problems of Joint Research, David D. Mason, North Carolina State College
Problems of Applying Experimental Results to Commercial Practice, Earl R. Swanson, University of Illinois
Discussion: Glenn L. Johnson, Michigan State University

Thursday, Dec. 27, 8:00 p.m., Statler Hotel

Executive Committee Meeting
American Farm Economic Association

Friday, Dec. 28, 9:00 a.m., Statler Hotel

Information Needed for Rural Development Program
American Farm Economic Association

Chairman: Lowell Hardin, Purdue University
Status of the National Rural Development Program to Date, Donald Paarlberg, Office of the Secretary, U.S.D.A.
Our Experience in Approaching the Rural Development Problem at the State Level, C. E. Bishop, North Carolina State College
Discussion: Raymond Penn (Paarlberg), University of Wisconsin; W. B. Back (Bishop), Oklahoma A & M

Friday, Dec. 28, 2:00 p.m., Cleveland Hotel

Agricultural Policy—Recent Changes and Future Implications
American Economic Association and American Farm Economic Association

Chairman: Karl Brandt, Stanford University
An Appraisal of Recent Changes in Agricultural Programs in the United States, Willard Cochrane, University of Minnesota
Policy Implications of Vertical Integration in United States Agriculture, John Davis, Harvard University
Discussion: Donald Kaldor (Cochrane), Iowa State College; William Capron (Davis), Stanford University

Friday, Dec. 28, 7:30 p.m., Statler Hotel

Smoker
American Farm Economic Association

Chairman: H. B. James, North Carolina State College
Informal Discussion (no formal program)
All agricultural economists are urged to attend

Saturday, Dec. 29, 9:00 a.m., Statler Hotel

Changes in Marketing and Marketing Research
American Farm Economic Association

Chairman: Karl Fox, Iowa State College
Econometric Models of the Dairy Industry, Anthony Rojko, Agricultural Marketing Service, U.S.D.A.
The Changing Structure of the Food Market, George Mehren, University of California
Discussion: Robert Clodius (Rojko), University of Wisconsin; J. D. Shaffer (Mehren), Michigan State University

LAND ECONOMICS

A Quarterly Journal of Planning, Housing & Public Utilities

Founded in 1925

Among articles appearing in August issue:

Dispersion of Nonwhite Residence in Washington, D.C.: Some of its Implications ..... *George B. Nesbitt*

Some Aspects of Motor Carrier Costs: Firm Size, Efficiency, and Financial Health ..... *Merrill J. Roberts*

Locational Aspects of Economic Development ..... *John Friedmann*

Effects of Credit and Monetary Policy on Real Estate Markets, 1952-1954 ..... *Saul B. Klaman*

The Report of the Departmental Committee on Electricity Supply in Great Britain ..... *Lucile Sheppard Keyes*

Problems in the Use of the Public District for Ground-Water Management ..... *Stephen C. Smith*

Decentralization and Blighted Vacant Land ..... *Herman Berkman*

Published in February, May, August and November

Annual Subscription $6.00 Single Copy $2.00

Sterling Hall, University of Wisconsin, Madison 6

AMERICAN ECONOMIC REVIEW

Contents

Vol. XLVI *September 1956* *Number 4*

Articles

Liquidity Preference and Loanable Funds Theories ..... S. C. Tsiang
Interest Inelasticity of Investment Demand ..... W. H. White
On the Effectiveness of Monetary Policy ..... W. L. Smith
The Stability of Growth Models ..... Diran Bodenhorn
Lewis on Economic Growth (A Review Article) ..... P. T. Bauer

Communications

Program of the American Economic Association ..... D. R. Fusfeld
Comments ..... J. D. Black and E. E. Witte
Obsolescence and Technological Change:
Comment ..... D. F. Gordon
Reply ..... Marvin Frankel
Wage Guarantees of Railroad Employees:
Comment ..... S. H. Unterberger
Reply ..... M. A. Horowitz
Agriculture in the Nation's Economy:
Comments ..... L. H. Keyserling
Reply ..... J. D. Black
Technological Change and Aggregate Demand ..... Robert Eisner

The AMERICAN ECONOMIC REVIEW, a quarterly, is the official publication of the American Economic Association and is sent to all members. The annual dues are six dollars. Address editorial communications to Dr. Bernard F. Haley, Editor, AMERICAN ECONOMIC REVIEW, Stanford University, Room 220 Stanford, California; for information concerning other publications and activities of the Association, communicate with the Secretary-Treasurer, Dr. James Washington Bell, American Economic Association, Northwestern University, Evanston, Illinois. Send for information booklet.